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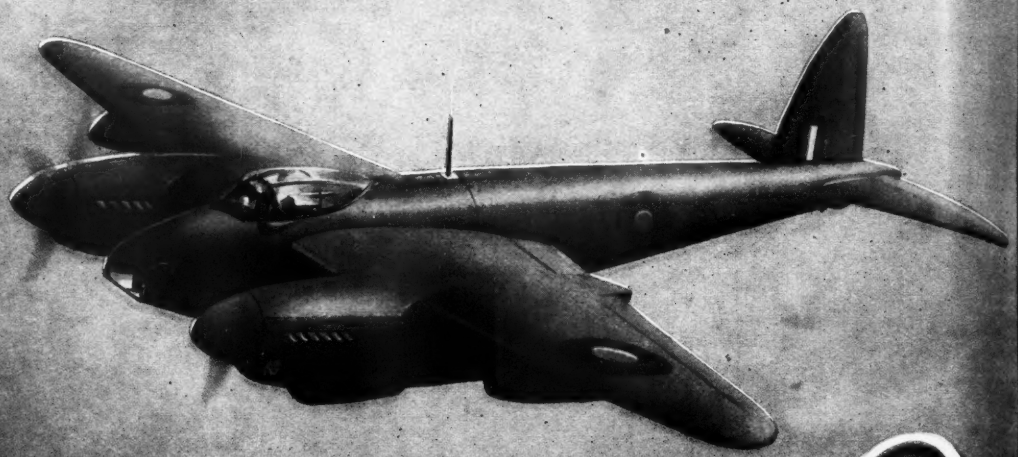

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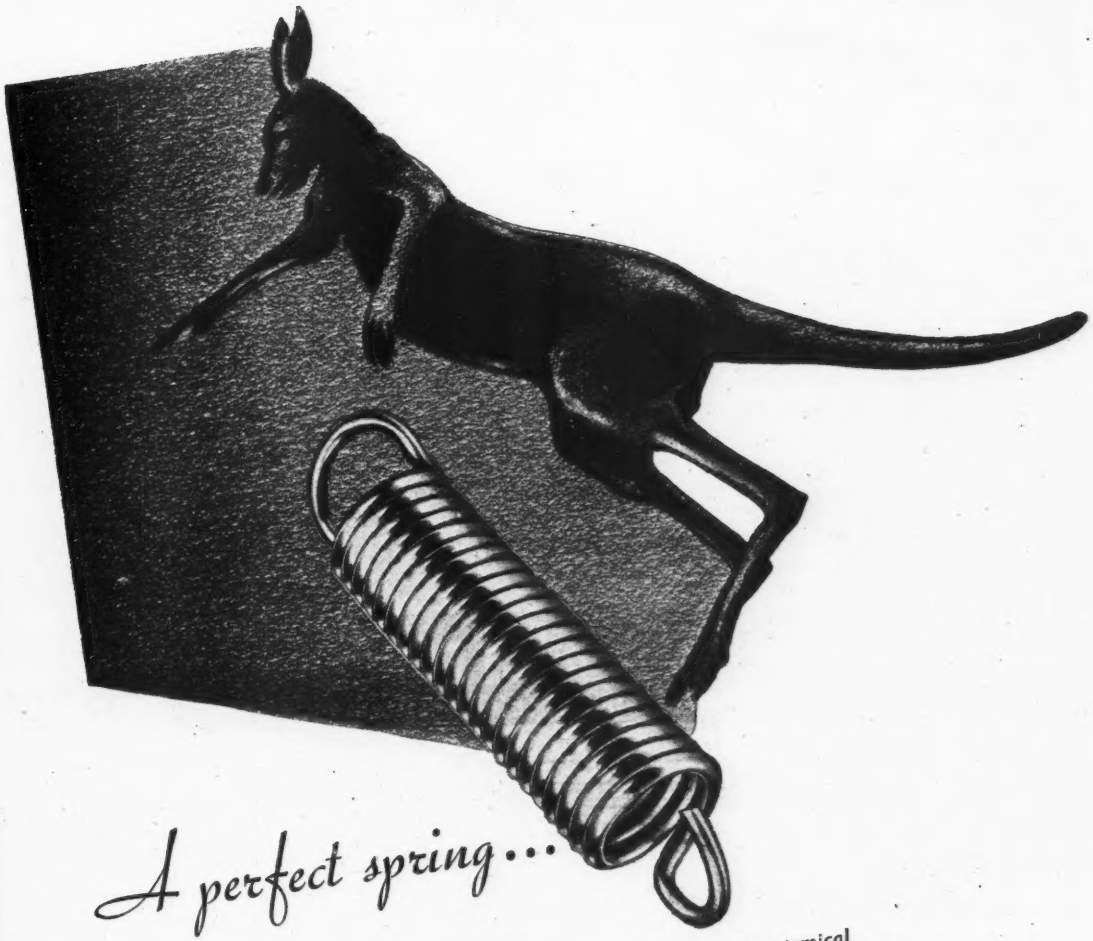

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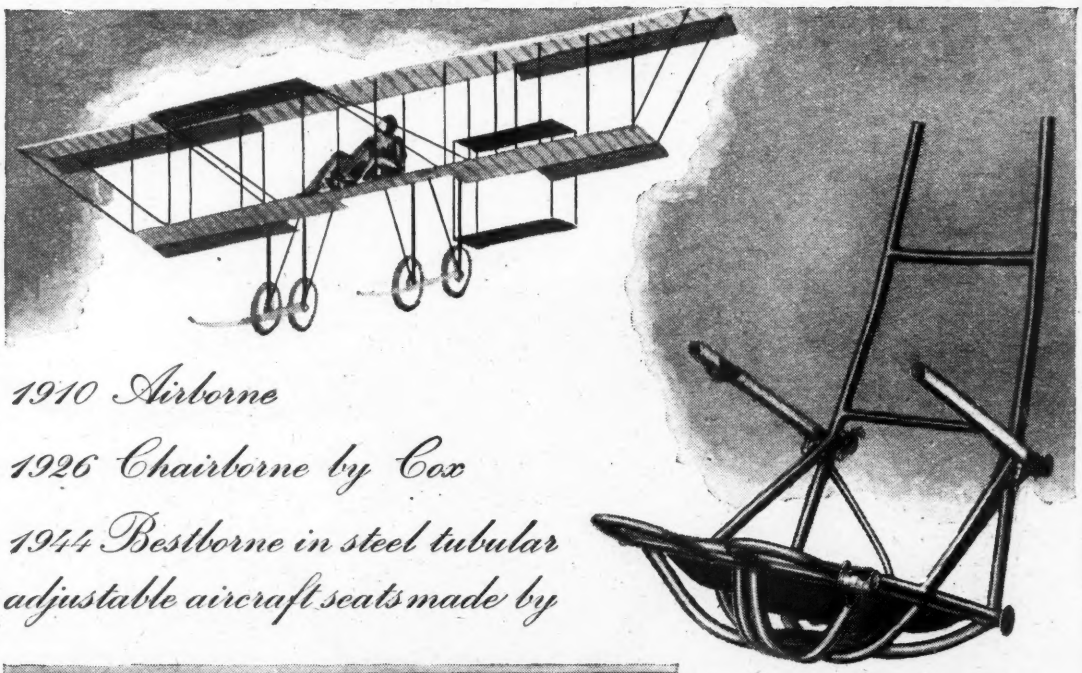

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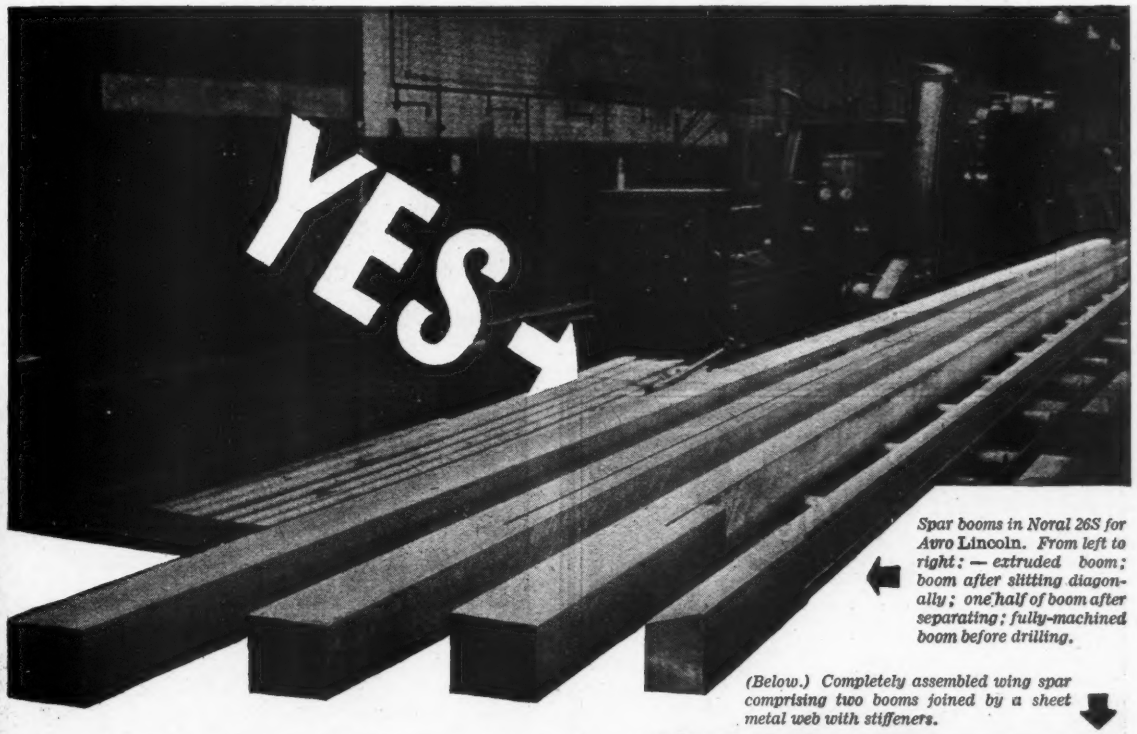
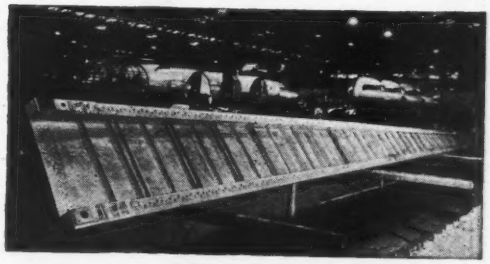


Spar booms in Noral 26S for Avro Lincoln. From left to right: — extruded boom; boom after slitting diagonally; one half of boom after separating; fully-machined boom before drilling.

(Below.) Completely assembled wing spar comprising two booms joined by a sheet metal web with stiffeners.



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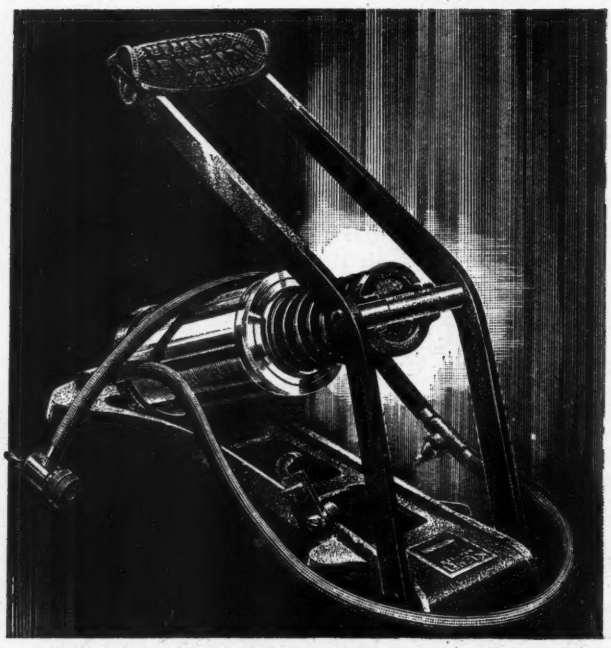

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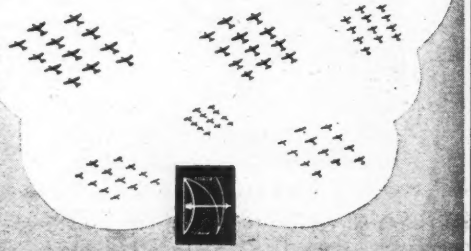

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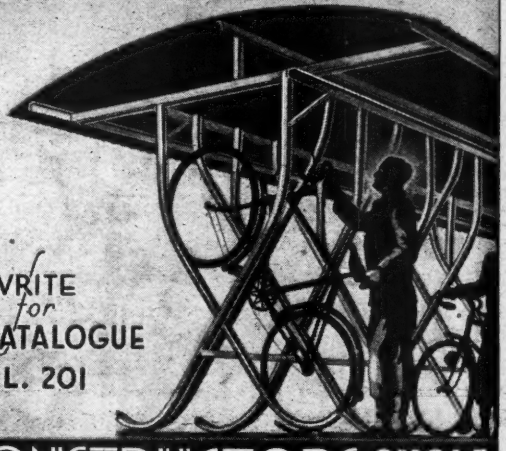

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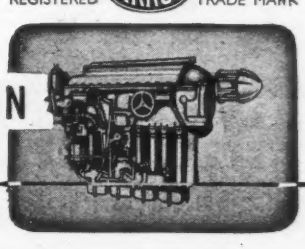

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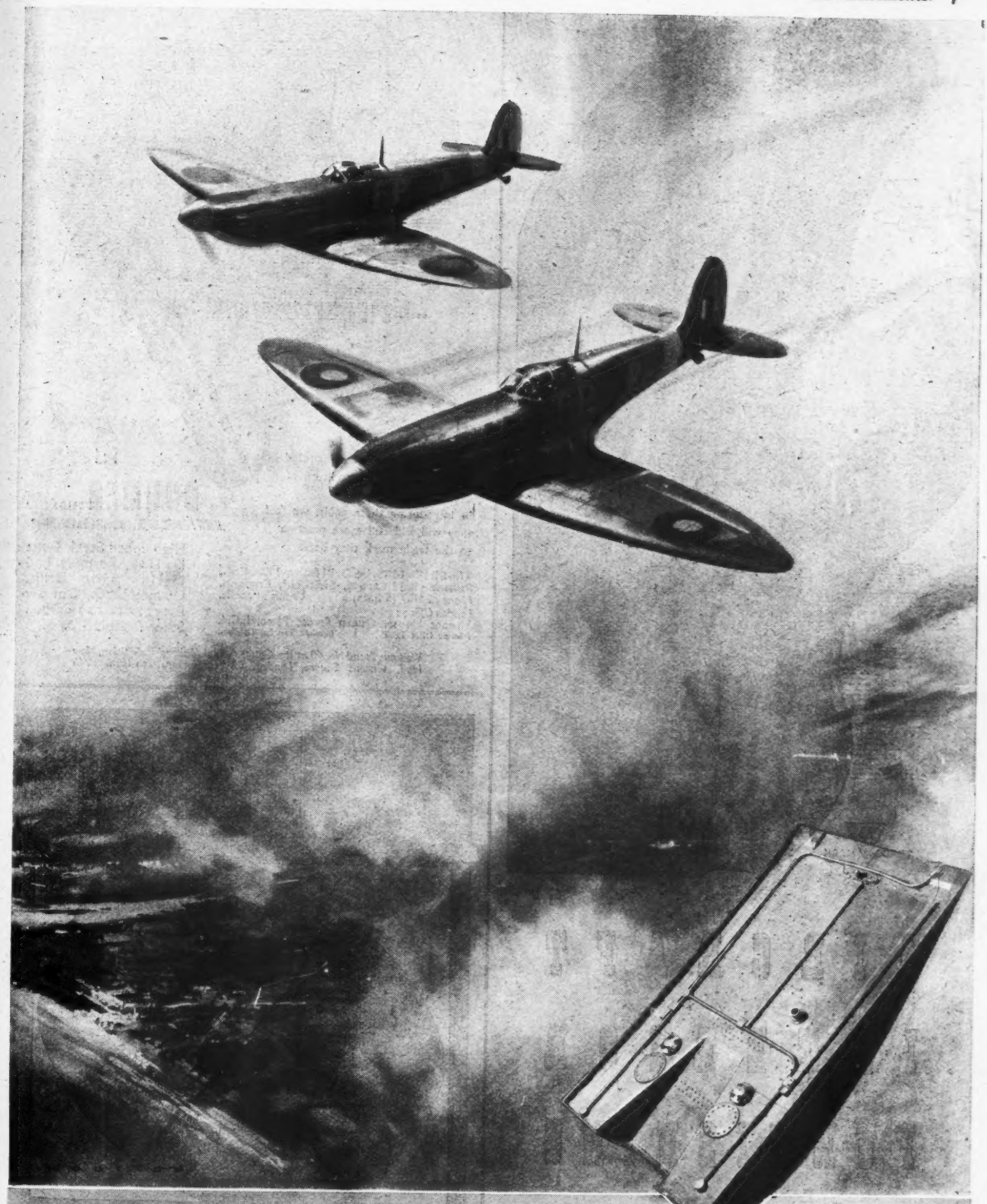

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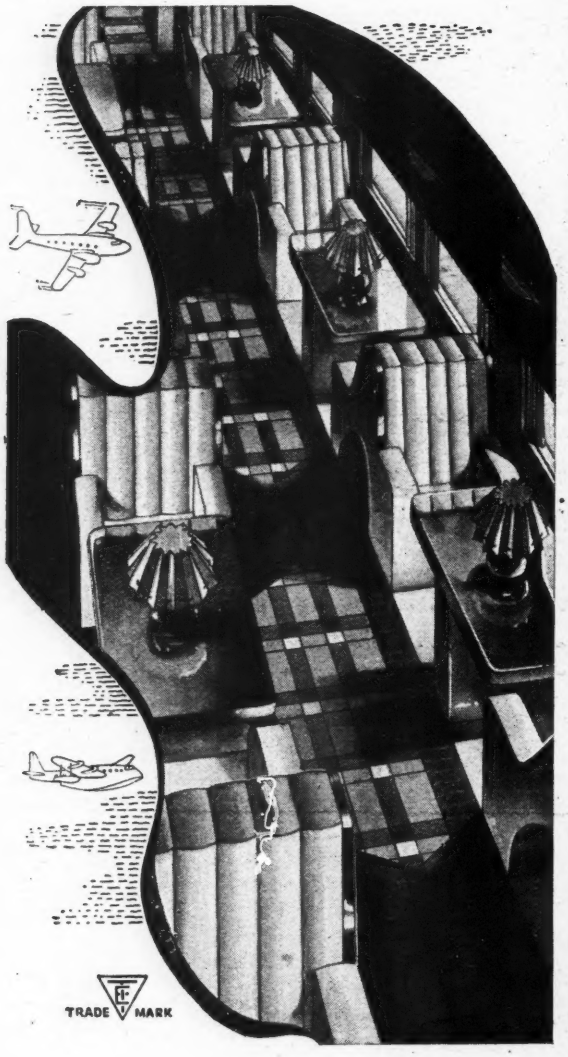

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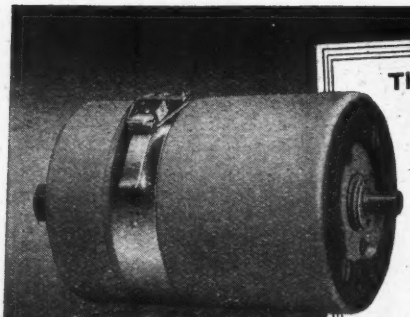

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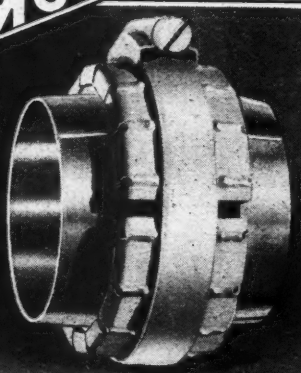

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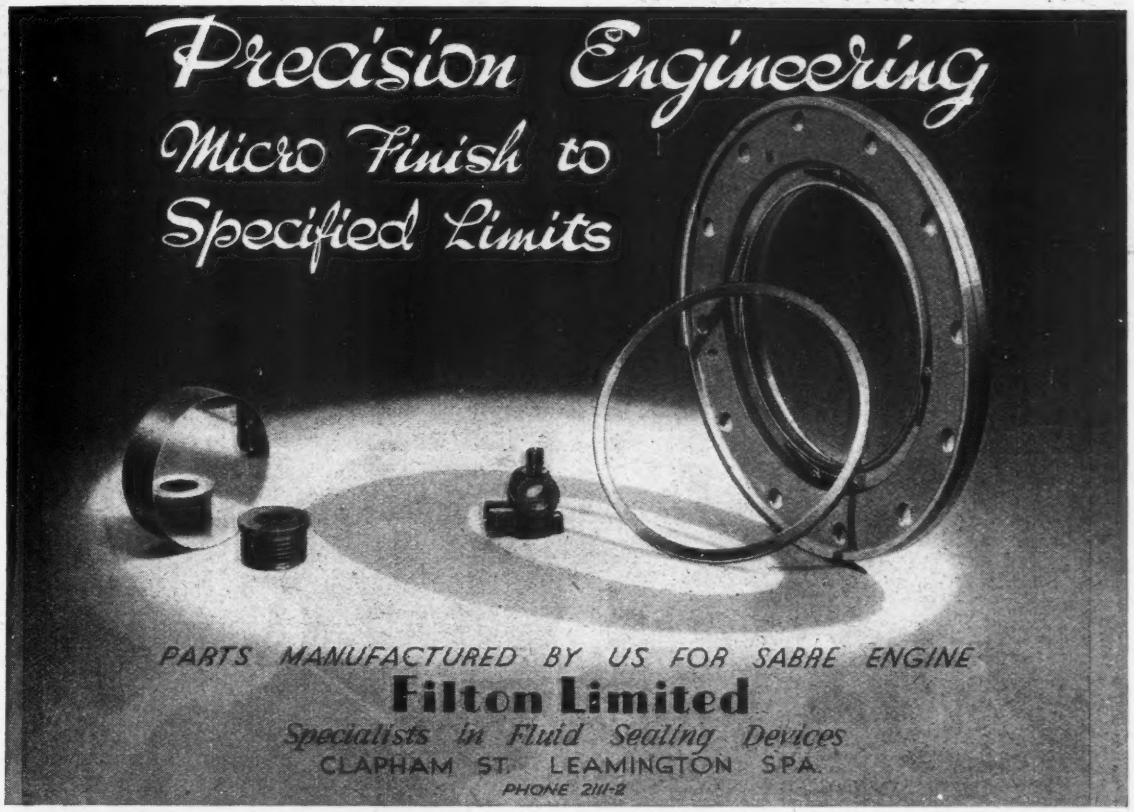

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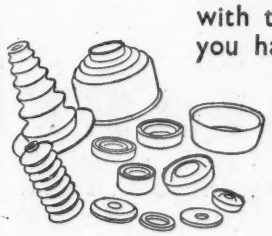

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The Outlook

What of the Clubs?

EVIDENCE of the tremendous interest taken in club flying by the younger generation, as well as by the not-quite-so-young who have been flying during the war and who are keen to keep their hands in, has been forthcoming during recent months in the form of numerous enquiries reaching our offices from all over the country. The information asked for can be summarised as: "Can you please tell me if there is a flying club in my district and if it has started operations?"

Lately a note of discouragement has characterised many of these letters, and a sense of frustration is clearly observable in others. Evidently a feeling is growing that, in spite of the lip service paid to the subject by many spokesmen, there is no real intention of doing anything practical in the way of encouraging clubs to acquire aircraft and to get people into the air.

There appears to be a tendency to blame the Minister of Civil Aviation for the delay. In all fairness it should be said that he has a difficult task. It is generally agreed that subsidies will be necessary if the cost of hiring aircraft is to come within the means of large numbers of people. We believe we are correct in thinking that Lord Winster is sympathetic, but he has to convince the Cabinet and the Treasury of the necessity for spending the taxpayers' money in this way.

In the past the Air Ministry has not been inclined to regard the club-trained pilot as being of any great use to the R.A.F., which naturally prefers to do its own training in its own way. No doubt there is every justification for this view where operational crews are concerned, but club-trained pilots certainly proved their worth on non-operational work at a time during the war when the shortage of pilots was acute. In fact, it might not be an exaggeration to suggest that, had it been necessary for the squadron pilots to collect their own aircraft at the time of the Battle of Britain that battle might never have been won. The Fleet Air Arm, too, made good use of amateur pilots for miscellaneous duties.

Similar conditions are not likely to appear again, but there is at least one powerful reason for the continuation of financial assistance. The A.T.C. is, in future, to form the main intake for the R.A.F., but what of those members of the A.T.C. who remain in civil life yet who can still be considered as prospective Air Force recruits in any emergency? And what of the need for maintaining a member's enthusiasms and interest during his days in the Corps? Whether or not the A.T.C. ultimately has any ties with the clubs, it is obvious that the nation's degree of interest in flying must inevitably affect the enthusiasm of the A.T.C. in direct ratio. There are a score of other good, if indirect, reasons why a club subsidy could be a paying proposition from the national viewpoint.

Unfortunately, the value of "air mindedness," if we can be forgiven for using that hackneyed word, cannot be directly assessed in pounds, shillings and pence.

The Amphibian Again

FROM time to time the subject of amphibians crops up afresh. Superficially the idea is attractive. The ability to take off and alight on water or land with equal facility appears to widen the utility of an aircraft tremendously. The latest project to come to our notice is the Norwegian amphibian flying boat described in this issue. The penalty paid for the amphibious feature, a loss in payload, is always a heavy one. In this case it amounts to some 800 pounds of a total disposable load of 4,500 pounds.

There appears to be little doubt that for Scandinavian conditions this sacrifice may be worth while in comparison with the benefits which it bestows. The same might well be the case in other parts of the world, not forgetting parts of the British Empire, and the question arises whether British constructors would be justified in catering for such a specialised market. At the best, it would certainly not be a tremendously large one, and at the

worst it might be so small as to hold out little hope of recovering the cost of tooling and jigging.

There does appear to be a possibility that for certain charter work, which is to be the only class open to private enterprise, the increase in operational scope might more than outweigh the reduced payload. No British amphibian has been produced in modern times, but examples were not lacking in the past, and it would be interesting to see how a British designer would tackle the problem with the greater knowledge now available compared with the state of the art when the last amphibian was built.

Pioneers

JANUARY 11th, 1946, is destined to become one of the red-letter dates in the history of the Royal Aeronautical Society, not merely because it was the eightieth birthday of the Society (actually the first meeting of the council was held on January 12th, 1866) but because the anniversary dinner was held in London's ancient Guildhall, an honour which, as Sir Frederick Handley Page pointed out, was appropriate as well as being highly valued.

A technical society which ante-dates by nearly 40 years man's first controlled flight in a machine heavier than air, and which has contributed to the science of flight ever since, is deserving of the honour which the Lord Mayor and Sheriffs of London showed it by lending the hall which is so closely associated with the history and traditions of the Empire's capital.

The founders of the R.Ae.S., as the Minister of Supply and Aircraft Production so aptly expressed it, were far-sighted to a remarkable degree. But a few years after the first run of Stephenson's "Rocket," they began to ponder the next step, the problems of getting into the air, problems which must have appeared to them almost insuperable. But they had faith and enthusiasm, and those qualities still animate the Royal Aeronautical Society.

Practically without exception, every designer, technician, research worker and test pilot who has contributed to the almost fantastic progress of the last 30 years or so is a member of the R.Ae.S., and their enthusiasm for the art, and faith in its well-nigh illimitable future, is undimmed by the years, as, indeed, it needs be if the problems of the future are to be solved.

As the solution of one difficulty carries us a step forward, another (or more often several) arises even more formidable. But one after another is solved, proof that our technicians have not only faith and enthusiasm but the tenacity which ultimately triumphs over all obstacles. The R.Ae.S. began pioneering in 1866; its members are still pioneering in 1946.

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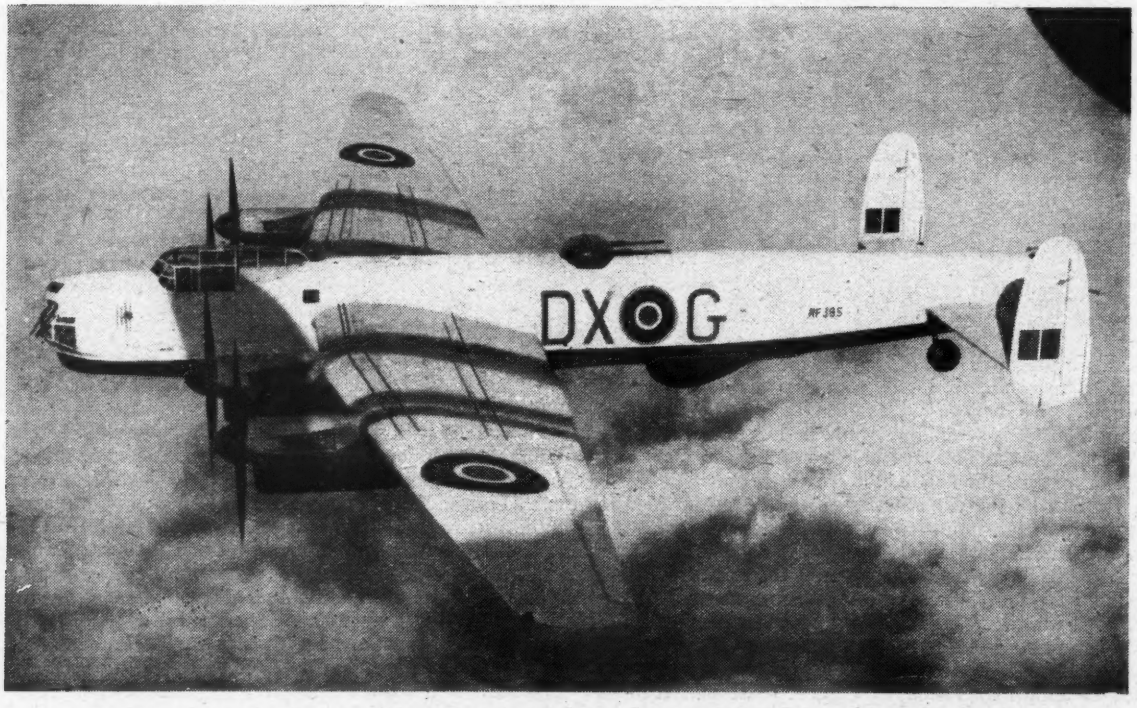
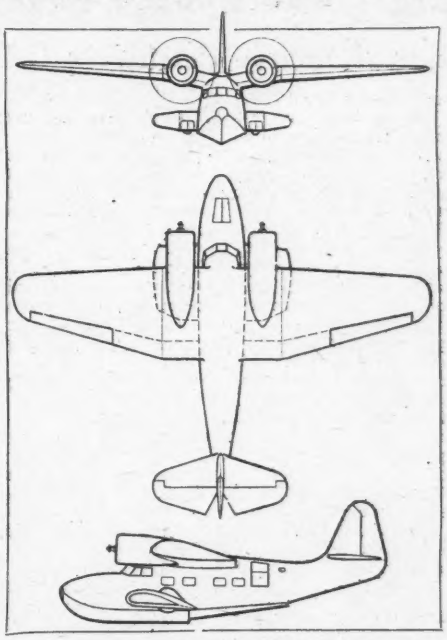


BRITAIN'S HEAVIEST BOMBER: The Avro Lincoln Mk.I which was primarily designed to carry the big 22,000-lb bomb both faster and farther than the modified Lancaster previously employed. Together with its gun turrets the Lincoln is described in detail on pages 57-64.

A Norwegian Amphibian

Twin-engined Civil Flying Boat with Wheel and Ski Undercarriage : Ten Passengers and Crew of Two

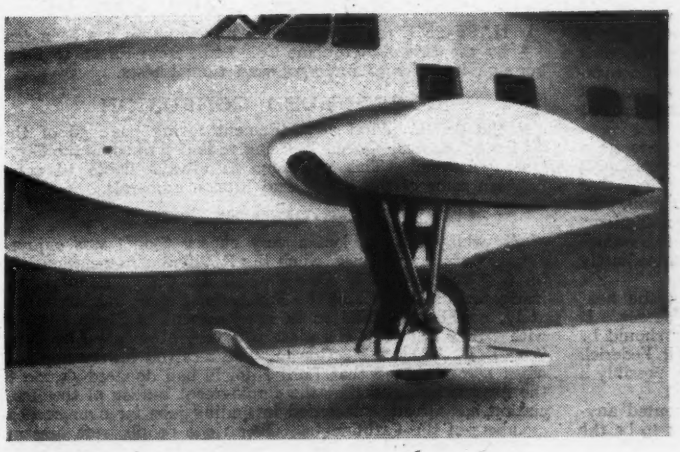
BEFORE, during and after the war we in Great Britain always found much to admire in little Norway. During the occupation we learned something of the way in which the Norwegians, in spite of tremendous difficulties and much suffering, managed to thwart the Nazis in all sorts of ways. We came to know many Norwegian airmen, whose work was held in high esteem by the R.A.F. King Haakon was a popular figure during his stay here, and we came to regard Riiser-Larsen as one of us and were sorry to lose him when he returned to his native land to take up a very important post.



Making a Start

And now, with the Royal Family once again safely back in Oslo and Norway once more master in her own country, we have cause to admire the way in which she is setting about the difficult task of getting back to normal. Even in the matter of aviation Norway is losing no time in making a start. A Norwegian firm has designed and begun construction of a ten-seater amphibian, a project which may well lead not only to Norway being self-supporting in this particular class but may even be in a position, presently, to export to other countries. A very complete mock-up has been built already, although the detail drawings must obviously have had to be produced in secret during the German occupation.

The firm in question is B. Hönningstad A/S, of Sköyen, near Oslo, and the new machine is known as the type 5A. In a general way it is of orthodox design in that it is a high-wing monoplane (to place the airscrews clear of water spray) with two radial engines mounted from the leading edge of the wing, and sponsons for lateral stability on the water. On closer examination, however, it is found that the design incorporates certain not very common features, notably in connection with the "amphibiousness" of the undercarriage.



The ingenious wheel-ski amphibious undercarriage.

British aircraft designers have, on the whole, not been very fond of using sponsons, the general opinion being that they tend to make for "dirty" running, and outboard wing floats have been used on practically all British flying boats. While they do undoubtedly make for cleaner running, they suffer from another disadvantage, that of vulnerability. When a flying boat is in trouble on the water the cause is nearly always the collapse of a float or its supporting struts.

Neat Wheel Stowage

In the case of the Hönningstad 5A there was very good reason for choosing sponsons. With their primary function as lateral stabilisers they combine that of supporting the land undercarriage, and by a very ingenious arrangement this combines wheels and skis. The general scheme is shown in an illustration. To the wheel axle and undercarriage struts is attached a ski in such a way that the wheel projects slightly through a slot in the ski. When the undercarriage is retracted, the ski fits snugly against the underside of the sponson, and about one-quarter of the wheel diameter remains exposed. This probably adds but little to the drag, and when the undercarriage is lowered the machine can be put down on a grass airfield or on the ice of a frozen lake or on a snow-covered field on which the snow is of too soft a nature to prevent the wheels from sinking-in.

It has always been the extra weight and complication of the land undercarriage which has prevented the amphibian flying boat from becoming really popular. According to our Oslo contemporary, *Norsk Fly-Tidsskrift*, to which we are indebted for this information and for the illustrations, the disposable load for the plain flying boat is 2,050 kg. (4,500 lb.). For the ski/wheel amphibian the figure is 1,690 kg. (3,725 lb.) so that the weight of the combined land undercarriage is apparently 775 lb. This means that for relatively short stages (435 miles) the weight of mails and parcels is reduced from 465 kg. (1,025 lb.) to about 105 kg. (230 lb.).

One may regard a loss in payload of nearly 800 lb. as a very serious one. Much will, of course, depend upon the geographical and climatic conditions on the route on which the machine is to be used. It must be remembered that Norway has been liberally supplied by nature with fiords and lakes, whereas the possibilities for establishing airports are distinctly limited, owing to the mountainous nature of most of the country. The fact that the machine can alight on fairly soft snow should help to avoid, or at least reduce, the not inconsiderable cost of sweeping or rolling the snow on an airfield.

The intention is to make the 5A of all-metal construc-

A NORWEGIAN AMPHIBIAN

tion so as to enable it to spend much of its time in the open. The maximum passenger accommodation will be for ten, with pilot and co-pilot or radio operator. Soundproofing and air conditioning will be on modern lines, but the seats are to be so designed that they can be removed quickly and the whole payload be in the form of freight or mails if desired. Dual controls will be installed, and full equipment carried, including that necessary for blind flying. Provision is also to be made for the installation of an automatic pilot. The machine will also be readily convertible into an air ambulance, with several stretchers and room for doctor and nurse.

There is little doubt that the 5A will find many applications in Norway itself, particularly in the northern part, and probably also in Sweden and Finland.

With seating accommodation for ten passengers and 960 lb. of petrol and oil the range is 435 miles. With full tanks and smaller payload this can be increased to about 600 miles, and with long-range tanks fitted the range can be raised to 1,550 miles. Maximum speed is estimated at 180 m.p.h. and cruising speed 160 m.p.h. The landing speed will be about 60 m.p.h. and the service ceiling 19,700ft.

Young Octogenarians

The Royal Aeronautical Society Celebrates Its Eightieth Birthday

LOOKING around at the distinguished company which filled London's ancient Guildhall on January 11th, one was profoundly thankful that the dinner did not have to be held during the war and that there was no danger of bombing. A hit on the Guildhall last Friday evening would have caused a serious gap in aviation progress for a long time to come, for the hall was mostly filled by heads of firms, designers, technicians, test pilots and many senior R.A.F. officers. The occasion was the eightieth anniversary of the Royal Aeronautical Society (we published an article on its history by the present secretary, Capt. J. L. Pritchard, in our issue of January 3rd) and it was, of course, a great honour for the Society to be granted the use of the Guildhall for celebrating the event.

Some 350 members and guests had gathered together under the chairmanship of the Society's president, Sir Frederick Handley Page, and messages were read from His Majesty the King, the Prime Minister, Mr. Churchill, Mr. Orville Wright, and Mr. Charles H. Colvin, president of the American Institute of the Aeronautical Sciences. According to the original toast list the R.Ae.S. was to have been proposed by Lord Winster, Minister of Civil Aviation, and replied to by Sir Frederick Handley Page. That of the guests by Lord Brabazon of Tara, with reply by Mr. John Wilmot, Minister of Supply and Aircraft Production. The late arrival of Lord Winster caused a slight rearrangement, but the speeches appeared not to suffer on that account; they were amusing and there was a lot of good-natured chaff.

Faith and Enthusiasm

Mr. Wilmot had been struck by two outstanding qualities in members of the Society: abounding faith and great enthusiasm. He recalled that when the Society was formed, the early enthusiasts had only just got used to railways; they began to ponder the problems of flight only some 35 years after Stephenson's "Rocket." That was faith. But in addition the Society had a thirst for knowledge. When actual flying began, the machines were wooden skeletons covered in fabric and abounding in struts and wires. During the first World War it had been his job as a rigger in the R.N.A.S. to look after those struts and wires.

Mr. Wilmot then briefly outlined the "cleaning-up" process which has resulted in the present-day clean aircraft and showed a very fair grasp of the main features of aircraft design, mentioning such modern aids to efficiency as laminar-flow wings and tailless aircraft. He expressed confidence that the spirit which had animated the founders of the R.Ae.S. would overcome such modern problems as flight at supersonic speeds, but at the same time he said the Chancellor of the Exchequer was well aware of the cost of the equipment needed!

Sir Frederick Handley Page recalled his early days as a member of the Society, when he was considered something of a rebel. Coming to modern times, he was not surprised that the tailless type of aircraft should appeal to a politician. To catch a bird one had to put salt on its tail! As for laminar-flow wings, the trouble was that if the aircraft flew into a swarm of flies and a few stuck to the wings, the drag immediately went up!

The R.Ae.S., Sir Frederick said, was educating the next generation so as to maintain continuity of improvement. It was essential that all who had the necessary brains should be given the chance to contribute. "We old ones," Sir Federick said, "must realise that youth can do the work and possibly a sight better than we."

Lord Brabazon of Tara disclaimed having contributed anything much to aeronautical science, but he did claim to be the first to have taken up a pig and thus disproved the old saying "when pigs fly." He recalled that the early fliers were regarded as amiable lunatics. He himself had once been referred to as the first certified pilot! In more serious vain he pointed out that there was still plenty of room for individual enterprise. In the very earliest days of flying the United States Government backed Langley, but two brothers from Dayton, Ohio, without any Government assistance, made their first successful flights a few days after Langley's failure. In more recent times, by way of showing that much can still be done by individual effort, he quoted Einstein, who caused a revolution without any expensive machinery.

In civil aviation, Lord Brabazon continued, we were behind America. It was no good trailing behind others, that was not the way to establish a lead. We should venture to skip a stage or two in an effort to get ahead. Two years ago the Brabazon Committee advocated jet-propelled civil aircraft. Where were they, he asked? No one would blame the Government if, by taking bold steps, they made occasional mistakes. But they *would* be blamed if they were over-cautious and let us drop behind. One of the tasks of the Government was to get rid of M.A.P. Mr. Wilmot had a difficult problem in dissipating the department of which he is head.

Lord Brabazon misquoted (without apologies to *Flight!*) "The Winster of our Discontent," but when the Minister of Civil Aviation replied, he pointed out that in the proper version the reference was to the *son* (sun) of York.

Lord Winster said that in civil aviation he would place the desirable features in the following order of importance: regularity, safety, comfort, and convenience. But he pleaded for a dropping of the expression "luxury." As to the future, it was in the jet and gas turbine field that we in this country would come into our own. We had not only the enthusiasm but the ability. One great difficulty was that to-day we had more ideas than we had technicians to carry out the research on them. He had been paying visits to a number of firms, and he was very encouraged by what was being done. He assured Lord Brabazon that we were not going to copy others. We were going to set the pace, and in the long run it would be others who copied us.

OUTSIZE MODEL

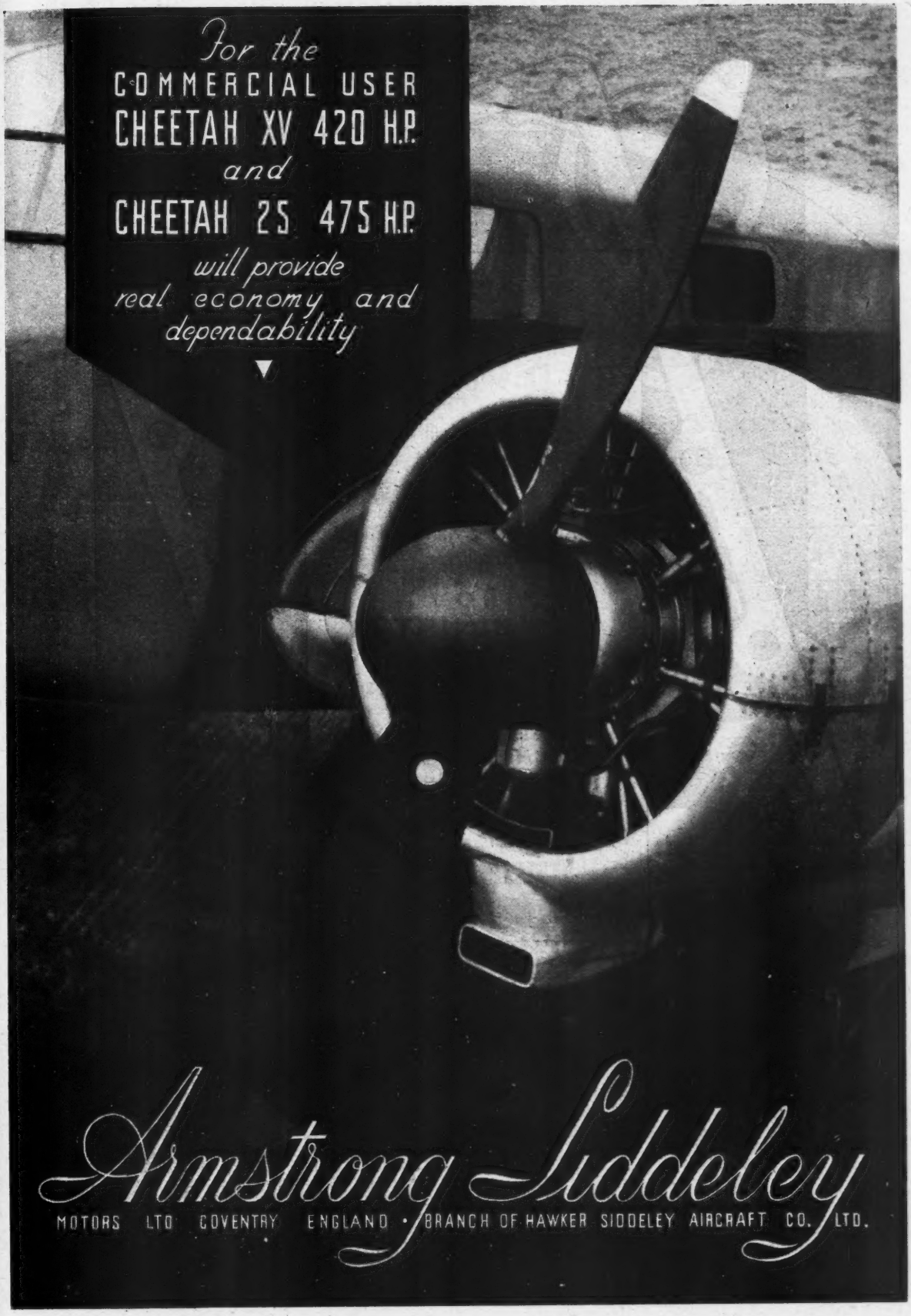
A HALF-SIZE model of the Bristol Brabazon has been sent by the Bristol Aeroplane Co., Ltd., from Filton to Farnborough in order to undergo wind tunnel tests.

CONFOUNDED CONFUSION

IN the de Havilland advertisement facing page 56 of this issue the Gipsy Queen Two engine is described as the Gipsy Queen Eleven. This confusion is always liable to occur between some of the Arabic and Roman numerals.

PATHFINDER REUNION

ON Friday evening last a very cheery "do" was enjoyed at Grosvenor House, when the Pathfinder Association held its first reunion. Air Vice-Marshal D. C. T. Bennett, the instigator and A.O.C. of the Pathfinder Force, was, unfortunately, unable to attend as he is at present in South America with "Star Light." His place was very ably taken by Wing Cdr. J. D. "Doc" MacGowan, who received hearty applause when he announced that Lord Nuffield had donated £1,000 to the Association, and that the employment bureau of the Association has already succeeded in finding jobs for over 200 ex-members of the Pathfinders. Over 1,000 people were present.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HERE AND THERE

WHAT MANCHESTER DID YESTERDAY: Just before VE-Day the U.S.A.A.F. experimentally adapted a B-29 to carry a 12,000-lb. bomb, but, as can be seen here, the American "Tallboy" was not so well streamlined as those dropped by R.A.F. Lancasters a long time before.

Short Notice

THE civil version of the Short Seaford S 45 flying boat is to be known as the Solent. This aircraft was described in detail in our issue of January 3rd, 1946.

R.Ae.S. at Peterhead

A BRANCH of the Royal Aeronautical Society has recently been formed at Peterhead and is to hold its meetings at the Palace Hotel.

Mr. W. Wood is the honorary secretary, and he tells us that Lord Brabazon has been invited to become president and to address the first meeting of the new branch.

Last Over "The Hump"

DAKOTAS of R.A.F. Transport Command made the last flight over "The Hump" between India and China on New Year's Eve, and this famous—or should we say infamous?—air route is now closed.

It was American pilots of the U.S. Air Transport Command, and Chinese National Airways, who pioneered this perilous air route to get supplies into China after the old Burma Road was lost.

Flying over the Himalayan spurs of North-east India, it was acknowledged to be the worst air journey in the world until Allied victories in North Burma made it possible to modify the route to avoid the highest peaks.

Valuable Capture

A REMINDER that R.A.F. personnel did some gallant fighting on the ground as well as in the air is given in a citation in a recent issue of *The London Gazette* which records the award of the M.C. to Flt. Lt. W. R. Jay, R.A.F.V.R.

This officer commanded an armoured flight on the Western Front and gained his award in an operation with a troop of armoured cars which enabled the force, of which his cars formed an important part, to gain its objective without casualties.

"The operation," says the citation, "resulted in the capture of the entire designing staff of the Focke Wulf Aircraft Co., together with many valuable secret documents.

Misleading Accuracy

THE celebrated preciseness of the *London Gazette* in all its announcements has recently led to a rumour that Acting Group Capt. Douglas R. S. Bader had retired from the R.A.F. This, as the Air Ministry points out, is definitely not the case; the famous pilot is an active figure at an R.A.F. station near London.

Without going into lengthy details, the misunderstanding arose because the wording of the announcement confirming Bader's war substantive rank of Wing Cdr. included the abbreviation "ret.," in brackets, as a formal reference to his retirement from the Service in April, 1933, after the crash in which he lost his legs.

As all the world knows, he talked his way back into the R.A.F. in November, 1939, and proved that artificial limbs can still work a fighter's rudder.

HIGH-SPEED HERALDRY: This strictly unofficial shield, designed by Flt. Lt. R. A. Johnson of the E.T.P.S. Flight, Manston has been presented to Group Capt. "Willie" Wilson by other members of the High-speed Unit. Our own heraldic interpretation is as follows:—On a field confused, red braces sans culotte. Superior, a marker balloon adrift, Walrus affronté and rescue launch rampant. Inferior, mailed fists with Woodbine tapped and digit extracted. Motto (freely translated) "Icy calm chaos, icy calm."

Compact Power

FEW wartime developments are more impressive than the manner in which engine designers have managed to squeeze more and more power out of a given cylinder capacity. The Merlin doubled its power output, and in the Griffon 65 the specific power has risen to 60.5 b.h.p. per litre. The Sabre Mark V gives 71 b.h.p. per litre, and in the Sabre VII the figure has risen to the astonishing value of 83.5 b.h.p. per litre.

Who, one wonders, will be the first to reach 100 b.h.p. per litre in an aircraft piston engine?

Acknowledgment from U.S.

DR. LEO. SZILLARD, one of the American pioneers in atom bomb research, recently told the Senate Committee investigating atom bomb control, that if Britain had not passed on to the U.S. in 1941 the knowledge previously gained by her scientists of the potentialities of uranium 235, American scientists might never have developed atom bombs.

While appreciating the acknowledgment, we are aware that this fact could be used to write an extra scene into "1066 and All That."

Gift to R.C.A.F. Fund

PRESENTATION of a cheque for $8,500 was made to the R.C.A.F. Benevolent Fund by the Air Force Veterans' Association of Montreal at the recent annual dinner in the Ritz-Carlton Hotel.

The money represented the Association's War Charities Welfare Fund, and was presented by Mr. J. D. Tudhope, president of the Association at the time the money was collected, to Air Marshal Harold Edwards, C.B., a member of the executive committee and a director of the Benevolent Fund.

Irish R.A.F. Club

AIR Force personnel from Eire will be interested in the formation of the R.A.F. Social Club in that country, of which the acting honorary secretary is Mr. H. B. Frazer, 34, Corrig Avenue, Dunlaoghaire, Co. Dublin.

The club's subscription is 7/6 for ex-Service and 5/- for serving members of

HERE AND THERE

the R.A.F. (including the Volunteer Reserve and Special Reserve), the Auxiliary Air Force, the Women's Auxiliary Air Force and Princess Mary's R.A.F. Nursing Service. Former members of the R.N.A.S., the R.F.C. and the Women's Royal Air Force are also eligible for membership.

It is hoped to arrange a meeting for all members early in the New Year and for the club to be taken under the wing of the R.A.F. Association. In the meantime, subscriptions should be sent to the Public Auditor, c/o The Manager, Provincial Bank, Dunlaoghaire, Co. Dublin, Eire.

Exclusively Yours

ONE of the more amiable by-products of war's grimmer moments is the "escaping" club; for example, the Caterpillar Club for those who have "hit the silk" in dead earnest, the Goldfish Club for those who have returned to base via a rubber dinghy, and the Winged Boot Club for those who have hoofed it home over the African desert.

A less general organisation is the "319 Club," whose members are drawn from the first batch of R.A.F. pupils to go to the U.S. for flying instruction. Their hon. secretary is Mr. A. W. Hayward, 5, Radnor Court, Kenton Lane, Harrow Weald, Middx. (Tel.: Grimsdyke 345), who would like to hear from all members in order to arrange a reunion.

Incidentally *Flight* often receives enquiries about clubs of this kind and, as some have more or less petered out, we should like to hear from the secretaries of those still functioning so that we can pass on the "gen."

EXPERIMENTAL AMPHIBIAN: Designated the XPBM-5A, this amphibious version of the Martin Mariner patrol-bomber weighs 30 tons and is claimed to be the biggest of its kind in the world.

News in Brief

IT is announced that the Fokker aircraft factory at Amsterdam is to build aircraft for the Dutch Government in order to save foreign exchange. In the meantime, K.L.M. has recently acquired 14 Skymasters from the U.S.

* * *

The Society of Model Aeronautical Engineers is circularising club secretaries, the trade, and influential persons interested in aviation, setting forth a seven point programme ranging from technical education to the establishment of a central headquarters in London, and supported by a message from Sir Frederick Handley Page.

* * *

The use of photographs as "silent salesmen" in Britain's export drive is the idea behind a "Photography and Export Exhibition" to be staged soon after next Easter by the Institute of British Photographers. This should interest firms in the aviation industry, and full details can be had from the Institute at 49, Gordon Sq., London, W.C.1. (Tel. Euston 3143.)

* * *

Flight is authoritatively informed that there is no foundation for the reports that the Secretary of State for Air, Viscount Stansgate, intends to resign his office. Viscount Stansgate accepted his post without any stipulation that he was only prepared to hold his appointment for a limited period.

* * *

The Canadian Air Minister, Col. the Hon. Colin Gibson, arrived in Britain recently to begin an inspection of all R.C.A.F. units overseas, especially those of the occupation force. He landed at Northolt in the Canadian Prime Minister's silver Liberator and was accompanied by the Deputy Air Minister, Mr. H. F. Gordon, and the Air Secretary, Group Capt. T. Macfarlane.

* * *

The death is reported on New Year's Day of Mr. Ernest A. C. Dell, chief draughtsman to Tecalemit, Ltd., who succumbed to an attack of pleurisy after an illness of only a few days. He had been with the company for more than 13 years.

* * *

Mr. E. L. Gandar Dower, managing director of Allied Airways, is one of a party of six M.P.s who left Croydon last week by Transport Command Dakota to visit Austria for the purpose of studying social and housing conditions in that country.

* * *

An aircraft modellers' scaled drawing of the D.H. Vampire, with various fuselage, wing and tail boom sections shown, is one of the features of the January number of *Model Aircraft*, the journal of the Society of Model Aeronautical Engineers. With this issue, the journal appears in a new and enlarged form.

* * *

Mr. E. Hudson has retired from the board of Blackburn Aircraft, Ltd., after 25 years as a director; for 20 years he also acted as the company's secretary. His place on the board has been taken by the present secretary, Mr. A. F. Jopling, who joined the present company shortly after its incorporation in 1936.

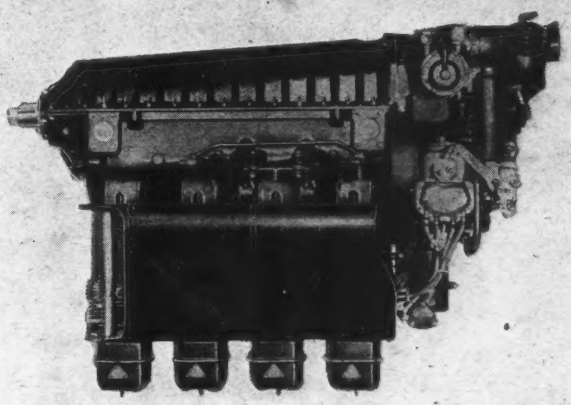
* * *

In the article on "Heathrow Airport," on page 37 of last week's issue, reference was made to the removal of silt from gravel pits which obstructed the construction of the main runway. The figure given should have read "600,000 cu. yd."

TUDOR'S TANKAGE. Three flexible containers with a combined capacity of 1,170 gal. of fuel fit into this tunnel in the wing of the Tudor I; they are drawn into position by cables.

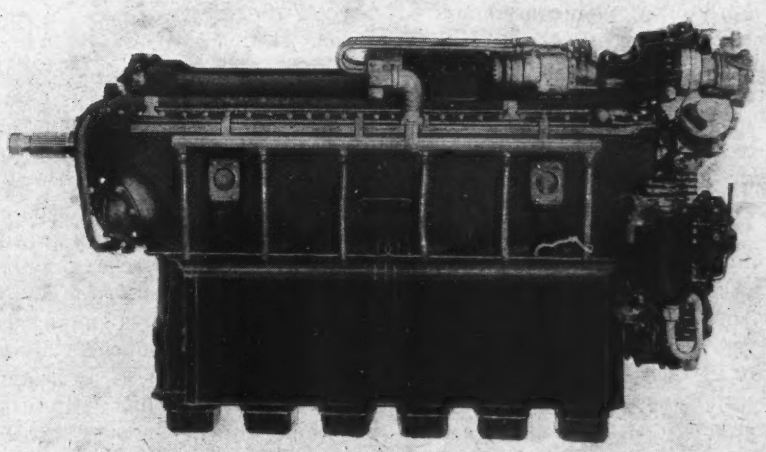
Production continues

In addition to the new range of Gipsy Major and Gipsy Queen Engines of 120 mm. bore and 150 mm. stroke, recently announced, The de Havilland Engine Co. Ltd. is continuing to produce (with a number of refinements) two world-renowned engines proven in long peace-time and war-time service.



GIPSY MAJOR 10 145 B.H.P.

This is the current production version of the famous Tiger Moth engine of 118 mm. bore, 140 mm. stroke and 6.124 litres capacity. The refinements now introduced increase its power from 130 to 145 b.h.p., make it suitable for variable-pitch propeller, and provide extra accessory drives.



GIPSY QUEEN 11 210 B.H.P.

This is the latest model of the well-known Gipsy Six, of 118 mm. bore, 140 mm. stroke and 9.186 litres capacity, the power unit of the Percival Proctor and other aircraft. It is designed to drive a variable-pitch propeller.

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D H ENGINES

Painting by Anna Zinkeisen

This Present Age . . 9

Welfare and health in industry have rightly been given considerable prominence in recent years. With a complete appreciation of this important aspect of social progress, the management has initiated and supported many reforms based on the ever increasing knowledge of both preventive and curative medicine. Each works has its doctor and nursing administration; its ambulance station and adequate equipment. Over sixteen years ago, this organisation established Works Councils in each of its branches, to discuss all questions relating to the well-being of employees and bring them into intimate contact with the management. Measures which have been adopted go far beyond the terms of national legislation. Industrial hygiene cannot however, remain the concern of the State, management of industry, trade unions and the medical profession, but must also receive the full co-operation of the individual. Work is the means to procure greater enjoyment of leisure, and the working hours of each employee are only part of his life as a citizen of the nation. It is of paramount importance that a health consciousness should form a background of everyone's leisure and home life. Industry has done much, but to achieve the ultimate ideal the greatest responsibility lies with the individual.

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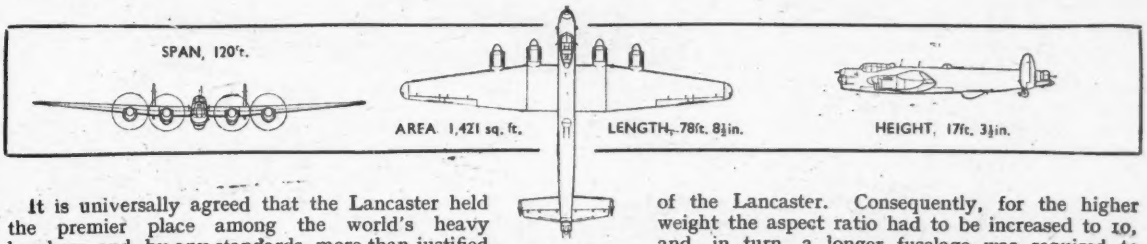
The AVRO LINCOLN

Great Bomb Load with High Performance and Long Range

THE final "release" of the Avro Lincoln now makes it possible to give a far more comprehensive review of the aircraft than the preliminary appraisal included in the November 1st, 1945, issue of *Flight*. At that time we referred to the Lincoln as "the mightiest bomber in the world," and now, having had an opportunity of examining the machine in detail, our original opinion is, if anything, emphasised.

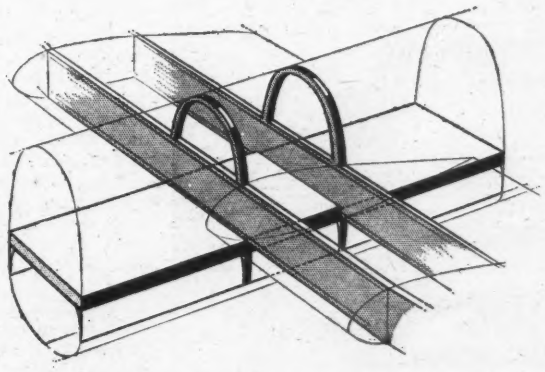


It is universally agreed that the Lancaster held the premier place among the world's heavy bombers, and, by any standards, more than justified its position. However, the Lancaster was not designed as a long-range machine in the present meaning of the term, and thus it became apparent that we should need a long-range alternative aircraft capable of handling really heavy bomb loads for dealing with Japan.

From the point of view of the aircraft designer these requirements are not easy of fulfilment due to their incompatibility, and when these qualities have, additionally, to be combined with a high level of performance, the case is aggravated.

In trying to fulfil these desiderata the Avro design team, in effect, took a Lancaster and increased it dimensionally whilst guarding against the proportional increase of structure weight. This meant that the designed stress factors had to be somewhat lower whilst maintaining an adequate overall factor for the fully loaded machine. That the c.p.f. load-factor is 4.0 at 82,000 lb. (high-angle case) can be taken as exemplifying the success of the effort.

Performance considerations demanded a high degree of manœuvrability and climb above 20,000ft., and to this end it was decided to maintain the same induced drag as that of the Lancaster. Consequently, for the higher weight the aspect ratio had to be increased to 10, and, in turn, a longer fuselage was required to produce a higher moment from the tail surfaces, and because of the increased moment, the incidence of the tailplane (which is standard Lancaster) had to be reduced by 1¼ deg.



Diagrammatic sketch showing how bomb load is spread over structure.

For an increase of wing size whilst keeping down the weight, some modified form of structure was essential, and so it was decided to dispense with spanwise stringers and, at the same time, increase the tensile strength of the material. This design, at slightly reduced factors in combination with the increase in aspect ratio, led to the production of a very flexible wing, although this applies only in bending; in torsion it has been established that the Lincoln wing is considerably stiffer than that of the Lancaster.

It is well worth noting

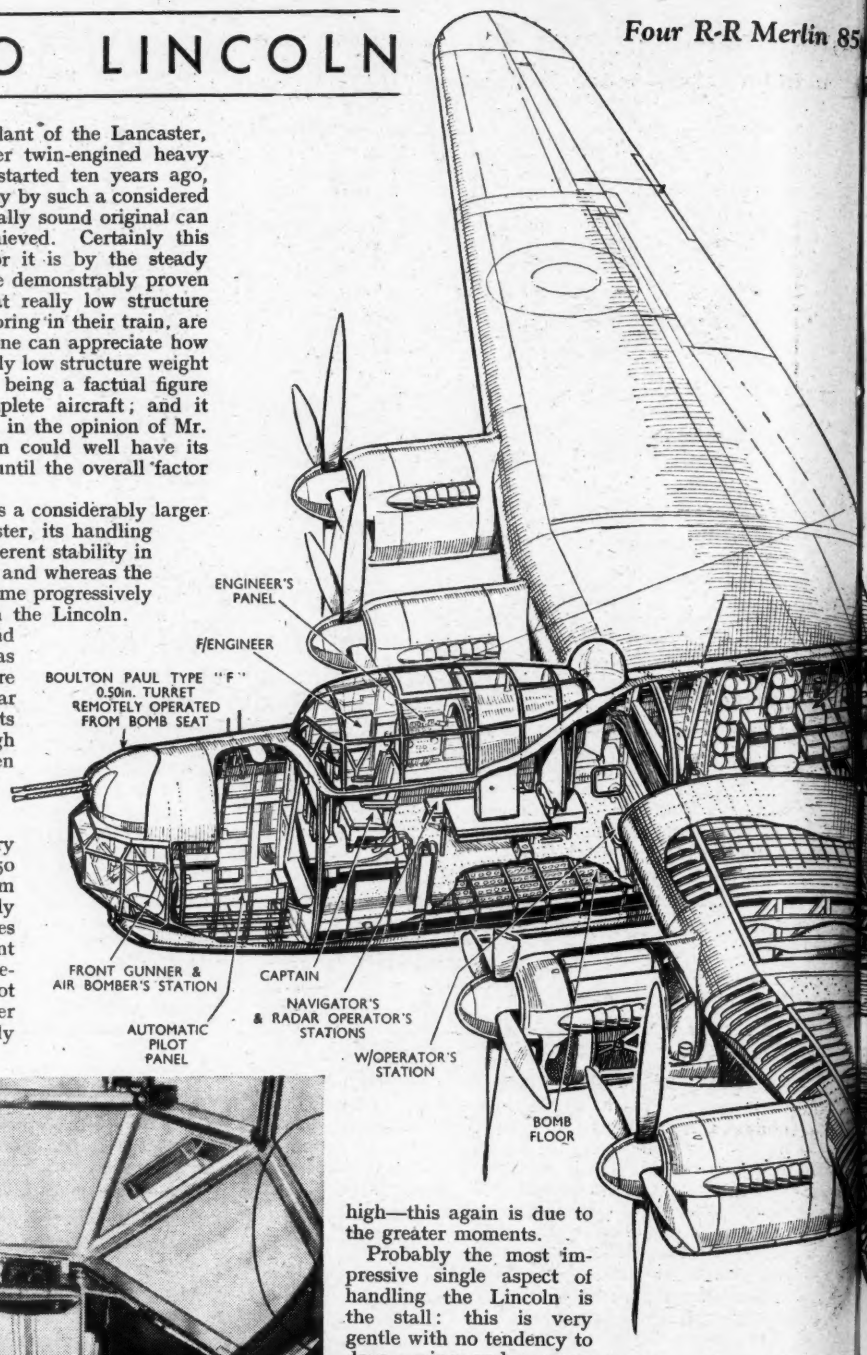
THE AVRO LINCOLN

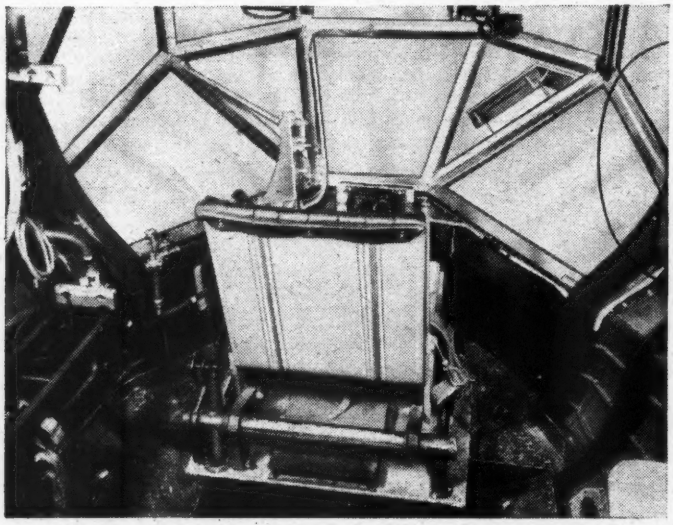
Four R-R Merlin 85

that the Lincoln is a direct descendant of the Lancaster, itself produced from the Manchester twin-engined heavy bomber for which the design was started ten years ago, and it is, perhaps, axiomatic that only by such a considered process of development from a basically sound original can the ultimate in type design be achieved. Certainly this can be said of structure design, for it is by the steady paring down of load factors to those demonstrably proven to be just above the safe limit that really low structure weights, with all the efficiency they bring in their train, are realised. Seeing this development, one can appreciate how it is that the Lincoln has the incredibly low structure weight of 25.2 per cent. at 82,000 lb., this being a factual figure proven by static tests on the complete aircraft; and it augurs well for future progress that, in the opinion of Mr. Chadwick, the designer, the Lincoln could well have its gross weight still further increased until the overall factor was brought down to 3.5.

Despite the fact that the Lincoln is a considerably larger and heavier aircraft than the Lancaster, its handling qualities are definitely superior. Inherent stability in all three planes of motion is marked, and whereas the Lancaster at high diving speeds became progressively nose heavy the reverse applies with the Lincoln.

Control forces for elevators and rudders are near enough the same as for the Lancaster, but ailerons are somewhat lighter; the reduction in gear ratio and increase in lever moments being partially responsible, although the fact that static friction has not been increased proportionally is also a decisive factor. Furthermore, the load curves for the ailerons show that, initially, load increases very slightly with deflection up to about 50 per cent. of the angular range, from which point the load increases fairly steeply, whereas the Lancaster curves give a progressively linear gradient throughout the range of aileron movement. Response to controls is not quite so immediate as in the Lancaster although their efficiency is equally high—this again is due to the greater moments.





The front gunner/air bomber has a comfortable seat and a magnificent field of view through the new nose glazing.

Probably the most impressive single aspect of handling the Lincoln is the stall: this is very gentle with no tendency to drop a wing, and recovery is immediate and progressive with the nose seeming to have dropped only very little below the horizon. Additionally, there seems to be a good deal of all-round control response right down to the stall, with far more than usual elevator response well below the stall. With flaps and u/c. down stalling occurs at about 65 knots I.A.S.

Change of trim with opening of bomb doors, or lowering flaps or undercarriage, is slight and requires negligible corrective elevator force, whilst in normal flight the aircraft holds its trim so well that in smooth conditions she can

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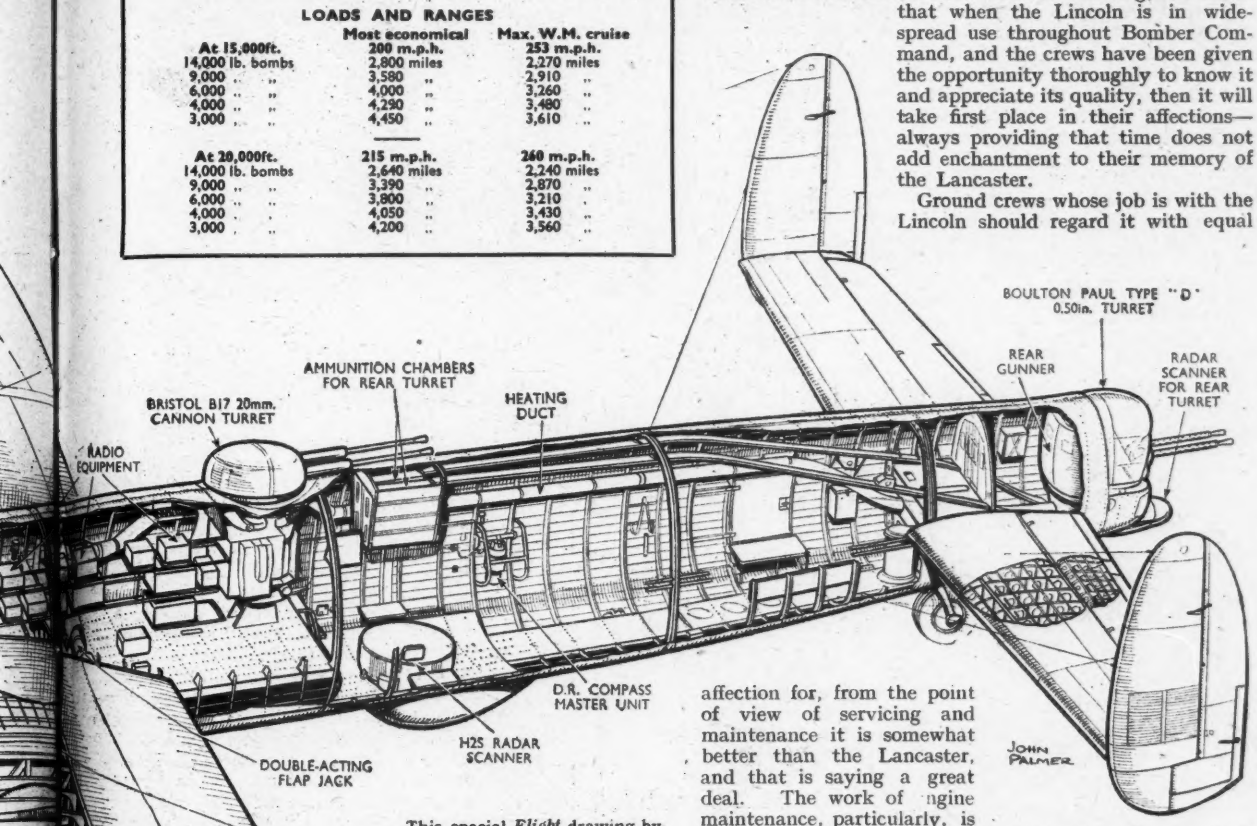
LOADS AND RANGES

	Most economical	Max. W.M. cruise
At 15,000ft.	**200 m.p.h.**	**253 m.p.h.**
14,000 lb. bombs	2,800 miles	2,270 miles
9,000 " "	3,580 "	2,910 "
6,000 " "	4,000 "	3,260 "
4,000 " "	4,290 "	3,480 "
3,000 " "	4,450 "	3,610 "
At 20,000ft.	**215 m.p.h.**	**260 m.p.h.**
14,000 lb. bombs	2,640 miles	2,240 miles
9,000 " "	3,390 "	2,870 "
6,000 " "	3,800 "	3,210 "
4,000 " "	4,050 "	3,430 "
3,000 " "	4,200 "	3,560 "



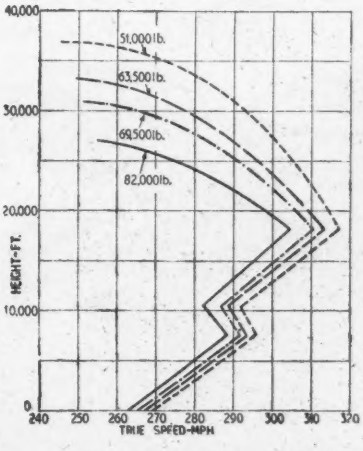
This special *Flight* drawing by John Palmer clearly shows the interior layout of the Lincoln, together with the extremely light and simplified wing structure, new circular-section engine cowlings and turret arrangements

be left to herself and will fly along as happily as though "George" were operating.

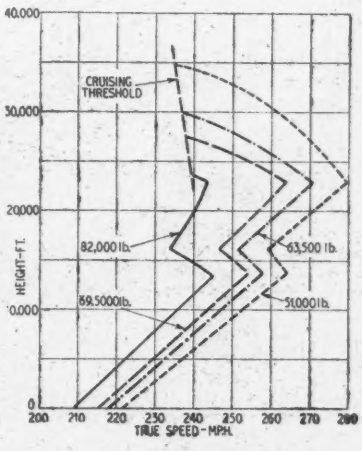
It is understandable that pilots who have had extensive experience of the Lancaster are unwilling to concede its pride of place to any other aircraft, even a bigger and better Avro machine; but we have not the slightest doubt that when the Lincoln is in widespread use throughout Bomber Command, and the crews have been given the opportunity thoroughly to know it and appreciate its quality, then it will take first place in their affections—always providing that time does not add enchantment to their memory of the Lancaster.

Ground crews whose job is with the Lincoln should regard it with equal affection for, from the point of view of servicing and maintenance it is somewhat better than the Lancaster, and that is saying a great deal. The work of engine maintenance, particularly, is greatly facilitated by the new cylindrical cowlings which house the Rolls-Royce Merlin 85 power plants.

We might here point out that the Lincoln IB has Merlin 85s; the Lincoln IIB is equipped with Packard-built Merlin 68s (the American-built equivalent of the 85); whilst the Lincoln XVB is built in Canada, and the Lincoln XXXB is built in Australia—the B in the designation denotes that the aircraft is a bomber.



Curves of max. level speeds against height for various all-up weights.



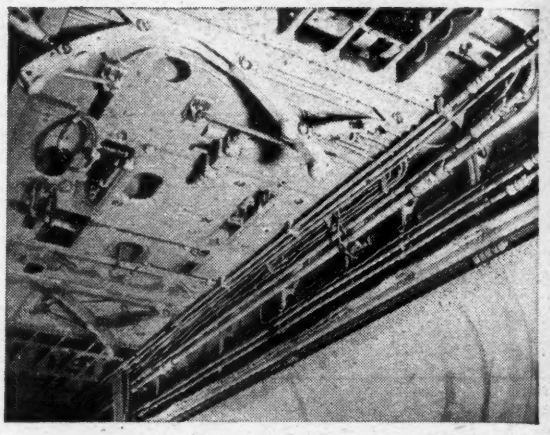
Curves of max. W.M. cruise speeds against height for various weights.

FLIGHT COPYRIGHT

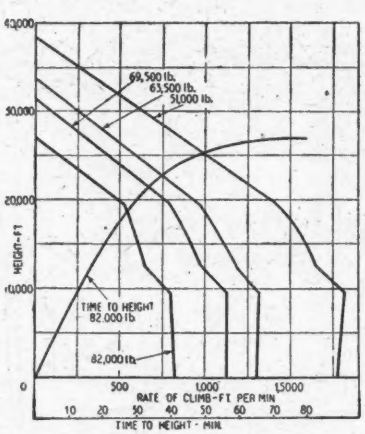
THE AVRO LINCOLN

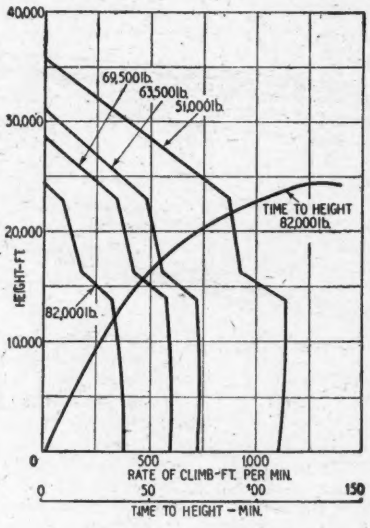
The bomb capacity of the Lincoln is the same as that of the Lancaster, both aircraft having identical bomb-bays. This physically limits the maximum bomb-lifting capacity of the Lincoln to a value below that which it has the power to lift. However, maxima are very rarely capable of being combined, and thus the most efficient aircraft in any field is that in which the most effective compromise is made between the highest individual values. In the case of the Lincoln the load/range requirement was to obtain the greatest number of alternative operative conditions between maximum range and maximum load within the framing limits of the engines, and with what degree of success this has been realised may be appreciated from the tabulation of bomb loads and ranges.

Structurally the Lincoln is very similar to the Lancaster, although there are considerable differences in the wing; but the fuselage is built on Lancaster principles embodying light channel-section frames notched for intersection with the plain angle stringers. As mentioned previously, the extra length of fuselage necessitated reducing the incidence of the tailplane by 1 deg. 15 min., and in order to obviate a modification of the attachment fittings, the rear fuselage is "cocked up" the requisite amount by raking the face of the jointing frame where it meets the intermediate fuselage.



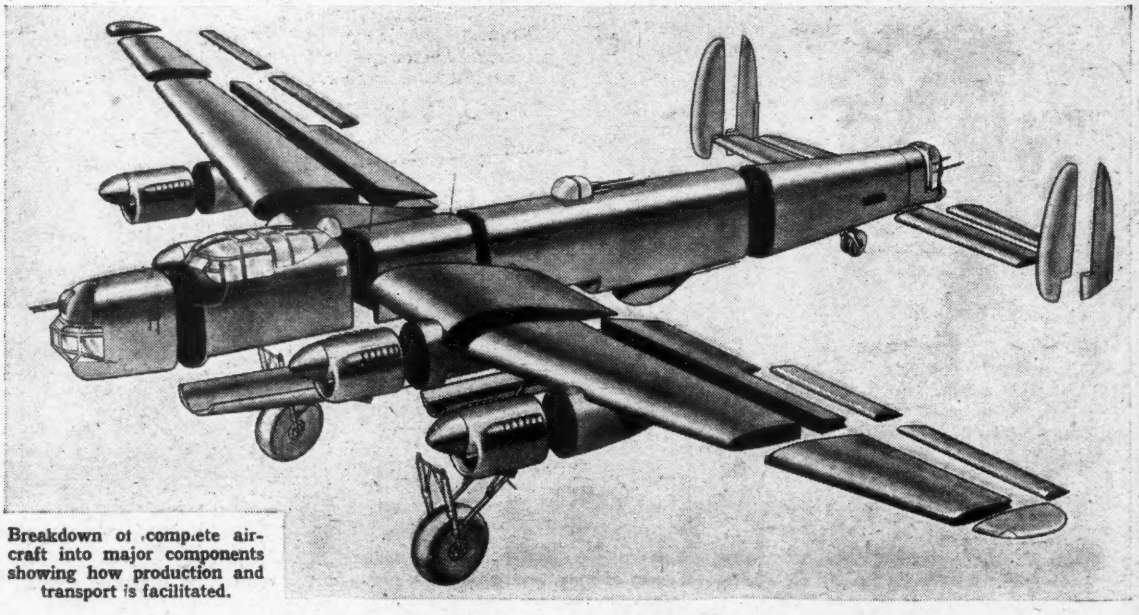
Bomb bay in centre-section showing main sling attachment and steady-crutch for 22,000 lb. bomb.



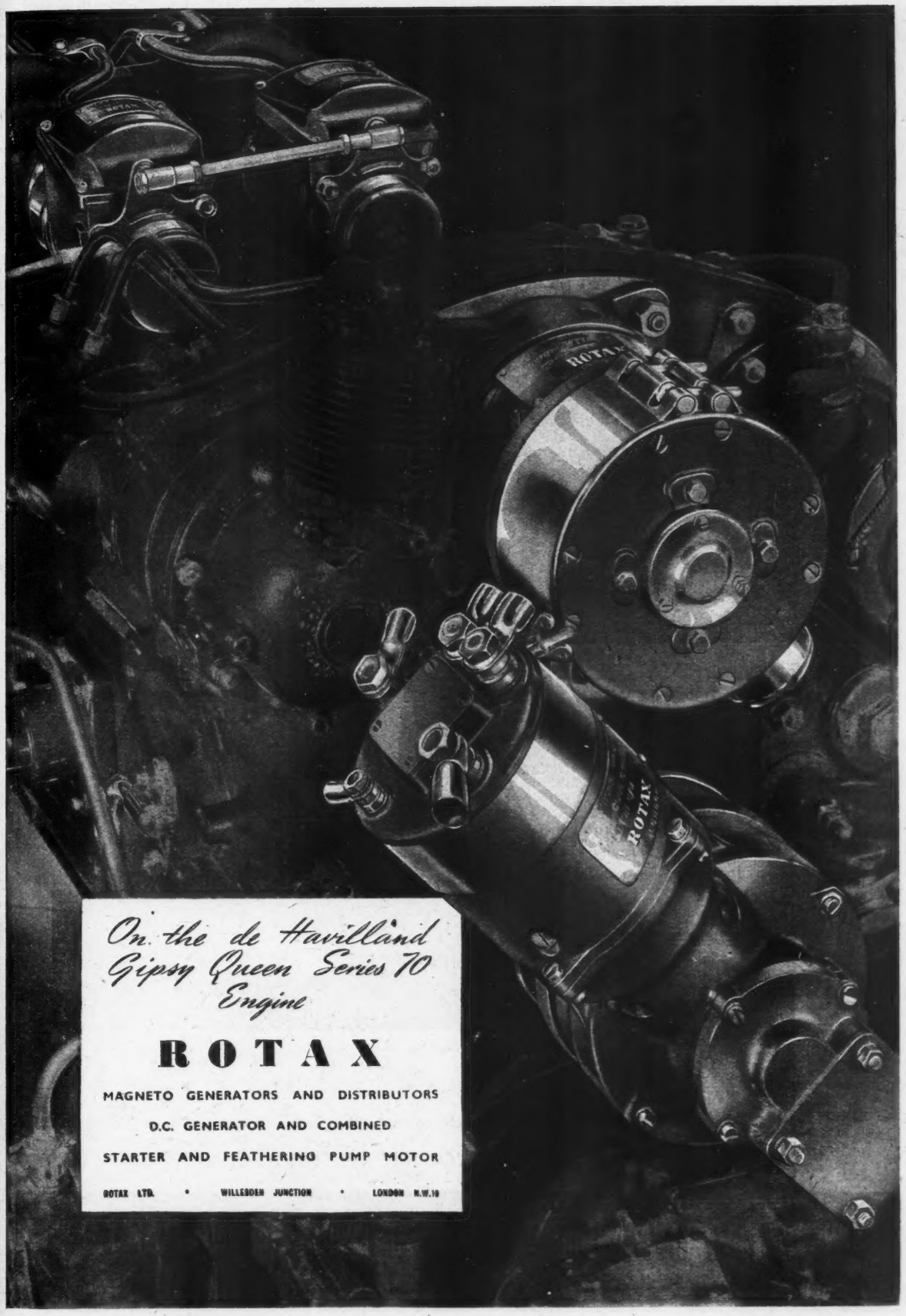


Curves of max. climb performance at max. climbing power, and (right), similar curves for max. cruising power.

The main bomb floor, as in the Lancaster, is composed of C-beams and C-intercostals bounded by extruded members of flanged channel section taking the form of longerons. In the centre-section portion of the bomb floor are two massive channel-section cast beams running athwartships about 18in. apart, the foremost being roughly two feet abaft the front spar; centrally between these beams are two equally massive cast intercostals which carry the sling fitting for the main (22,000 lb.) bomb suspension, and outboard of this on each side are auxiliary release hooks fitted in



Breakdown of complete aircraft into major components showing how production and transport is facilitated.



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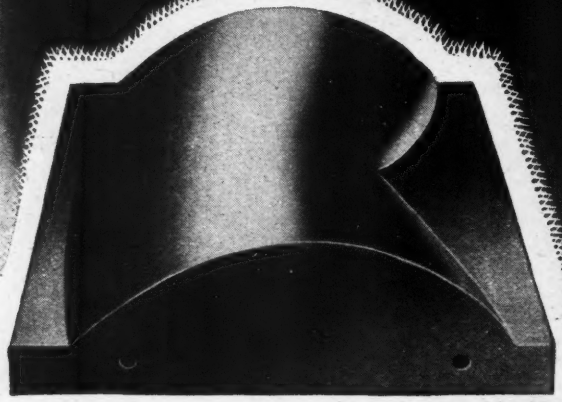

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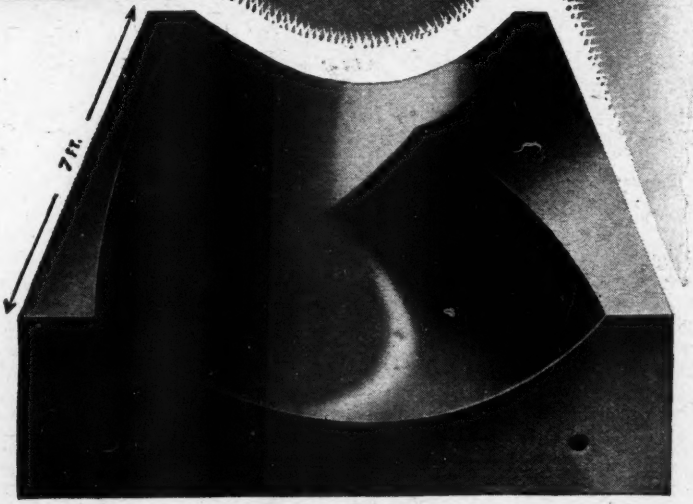

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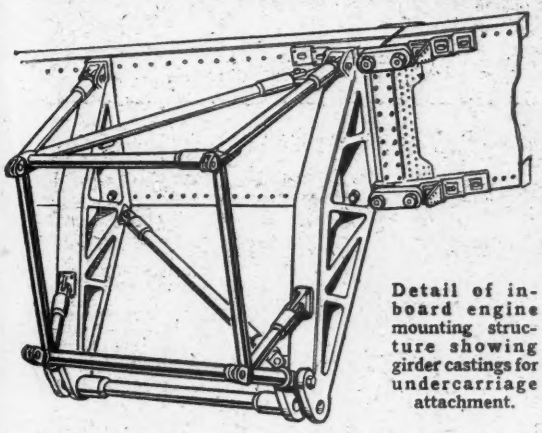
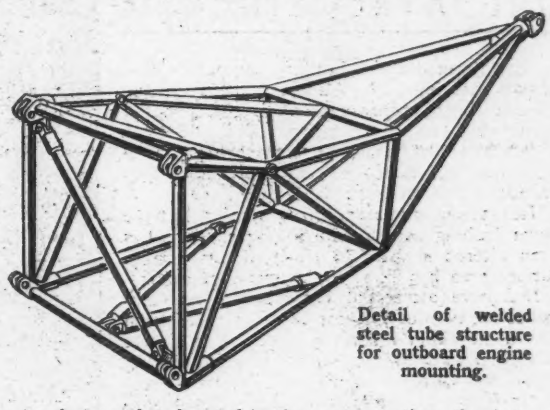
THE AVRO LINCOLN



Detail of inboard engine mounting structure showing girder castings for undercarriage attachment.



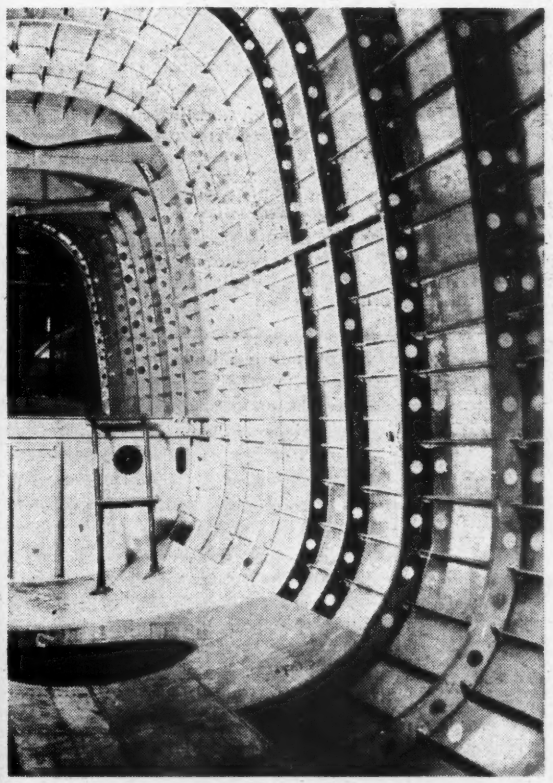
Detail of welded steel tube structure for outboard engine mounting.

doubled intercostals. In way of the main suspension beam the fuselage frames are heavy gauge pressings pierced, not notched, for the stringers.

Centre-section wing spars are similar to the Lancaster in having massive extruded square-section booms bolted to plate webs which are stabilised by top-hat-section vertical strips.

Between the inboard engines and the fuselage, tank bays are formed on each side between the spars, the ribs over each tank cell being built-up box-section chordal arches notched for the top-hat stringers. Primary ribs in the centre section are constructed of built-up box-section members as warren girder structures. By far the greatest structural strength is located in the centre-section, the intermediate wing panels being much lighter and the outer wing panels very much lighter still.

Spar joints, as may be seen from an accompanying detail, are formed by high-tensile steel shackle straps through bolted on each side of the spar booms, the spar webs being joined by a butt strap. Intermediate wing spars have extruded lipped square-section booms with plate webs. Most of the inter-spar volume of the intermediate wing is taken up by two tank bays, port and starboard, into which the anti-crash Marston collapsible fuel tanks are loaded from above and supported in doubled cradle ribs. Outboard engine loads are taken by three large warren-girder-braced ribs with light stabilising ribs interposed; whilst outboard of the outer tanks the ribs are very light structures of channel-section contour members with top-hat vertical stabilisers, and each pair of these is spaced by equally light pressed diaphragm ribs.

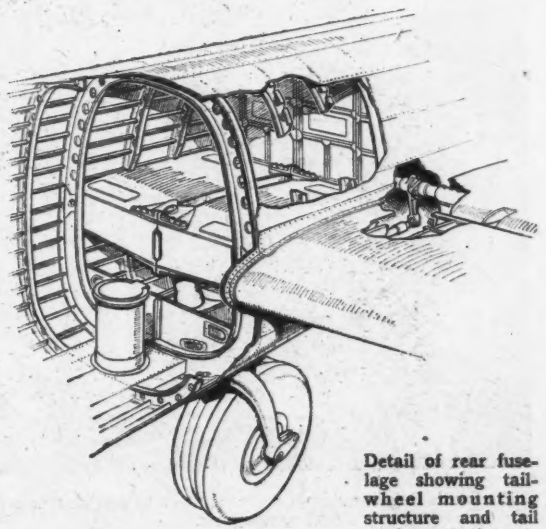


This view of the fuselage interior clearly illustrates the simple light structure employed.

Control Surfaces

The outer panels of the wings are built up around the same type of spars which, however, taper in scantling progressively towards the tip, and have pressed sheet ribs with large lightening holes in their diaphragms. As already stated, the wing structure is devoid of stringers, except in that portion of the centre-section extending over the inner tank bays.

Split trailing-edge flaps in the Lancaster manner are employed, using the same simple yet effective method of actuation by means of a double-acting jack and sliding tube with pivoted radius arms. Ailerons are fitted both



Detail of rear fuselage showing tail-wheel mounting structure and tail surface attachment.

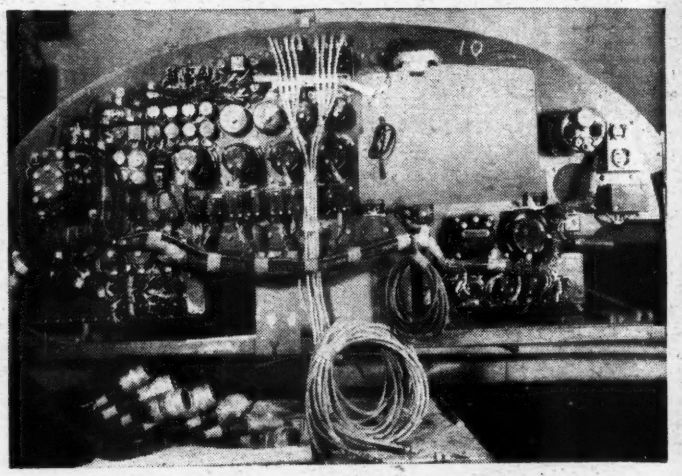
THE AVRO LINCOLN

to the intermediate and outer wing panels, and at the spar joint the connection between the aileron torque tubes incorporates laminated spring-steel leaves to permit relative movement in flexure whilst ensuring positive drive. Trimming tabs and direct-action servo-balance tabs are fitted port and starboard.

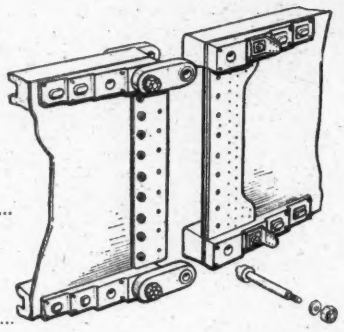
Tail surfaces are standard Lancaster, but the lower trailing edge profile of the rudders has been altered slightly to effect an increase of surface area by about one square foot each.

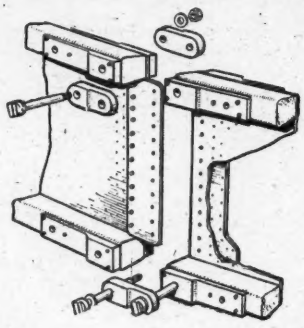
Defensive armament comprises a remotely controlled twin 0.5in. nose turret operated from the bomb-aimer's seat; a mid-upper turret mounting two 20 mm. cannon; and a twin 0.5in. rear turret with which is incorporated a radar sighting system. As these turrets are worth a detailed description as separate items of equipment they are being specifically dealt with elsewhere in this issue. The new glazing in the air-bomber's compartment is, however, an "aircraft" feature, and is particularly interesting in that it would appear logical that the flat facets, of which it is composed, might produce a rather unfortunate drag case compared to the nicely rounded Perspex "basin" used on the Lancaster—nevertheless, in actual fact, pressure distribution round the faceted nose has proved to be better than that of its rounded counterpart. Certainly the field of view and clarity of vision afforded by the new nose is really wonderful, and this, allied to the fact that the air bomber is provided with a quite comfortable seat instead of having to lie on his tummy should assist materially in his sense of well-being.

To sum up, it can justifiably be stated that, in the Lincoln, the R.A.F. have a heavy bomber exemplifying what can be regarded as the acme of contemporary functional design in aircraft. On every count of assessment the machine comes nearer the ultimate than any other heavy bomber in the world.

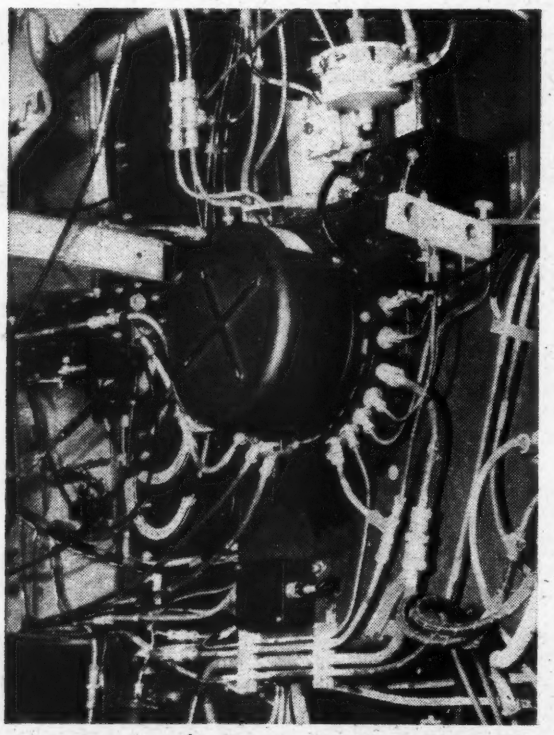


The neat arrangement of the mass of wiring to the pilot's panel.





Detail of typical spar joint showing method of attachment.



The Smith-R.A.E. automatic pilot is fitted to port at rear of nose compartment.

AVRO LINCOLN DATA

Wing area	1,421 sq. ft.
Aspect ratio	10.13
Dihedral (mean aerodynamic)	4 deg.
Aerofoil	NACA 23,000 mod.
A-U weight	82,000 lb.
Wing loading	57.75 lb./sq. ft.
Power loading (T-O)	12.54 lb./b.h.p.
T-O power	1,635 b.h.p.
Optimum econ. cruise	700 b.h.p.
Max. W.M. cruise	1,050 b.h.p.
Max. power (MS) at 5,750ft.	1,705 b.h.p.
,, ,, (FS) at 16,000ft.	1,580 b.h.p.

WEIGHT SUMMARY

For maximum range

		Per cent. A-UW.
Weight, less fuel, oil and bombs	49,416 lb.	60.20
,, fuel (3,580 gall.)	25,776 ,,	31.40
,, oil (150 gall.)	1,350 ,,	1.75
,, bombs and carriers	5,458 ,,	6.65
All-up weight	82,000 lb.	100.00

For maximum bomb load

Weight, less fuel, oil and bombs	49,416 lb.	60.20
,, fuel (1,275 gall.)	9,184 ,,	11.20
,, oil (100 gall.)	900 ,,	1.10
,, bombs and carriers	22,500 ,,	27.50
All-up weight	82,000 lb.	100.00

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The Lincoln's Defence

Details of the Bristol B-17 and Boulton Paul Types D and F Gun Turrets

ELSEWHERE in this issue will be found a review of the Avro Lincoln heavy bomber, but the gun turrets used on this aircraft are, of necessity, somewhat complex and highly specialised individual items of equipment worthy of specific appraisal in their own right.

First, the Bristol B-17 Mk. I turret which is fitted in the mid-upper position. This turret is designed for two Mk. IV or Mk. V 20 mm. Hispano cannon with ammunition capacity of 380 rounds per gun. A Bristol all-electric drive is employed for control in azimuth and zenith, the guns also being fired electrically. Laying is by means of a Mk. IIc gyro gunsight, and cocking and recocking is performed by compressed air.

The whole turret is supported from the aircraft deck in a turret top bearing, of which the turret mounting ring forms the inner rotating member and the turret support ring (attached to the airframe deck) the outer fixed member. The bearing media consist of a row of steel balls which take downward loads, with a row of rollers for upward and horizontal loads. A gear ring which is part of the turret rotation mechanism is mounted on the turret support ring.

Outrigger bearing brackets on the turret mounting ring support the gun cradle bearings, while brackets at the front and left-hand rear engage with three vertical tubes which support a metal understructure to which the seat and ammunition boxes are mounted. A diaphragm of armour plate which extends across the turret ahead of the gunner is used for supporting the turret motors, feed assisters and other components.

The gunner's seat is mounted on two horizontal tubes along which the seat may be moved to an optimum position in which it can be clamped. Both mounting tubes are hinged in front and supported at the rear by an adjustable anchorage which provides six positions for height adjustment, effected by a lever at the back of the seat.

The turret rotation motor is bolted vertically on the front face of the armour plate diaphragm on the left-hand side, and drives, through a reduction gear, a pinion which engages a toothed ring bolted to the outer fixed ring of the turret rotation bearing. A spring clutch which is designed to slip under excessive loads is fitted between the motor and reduction gear.

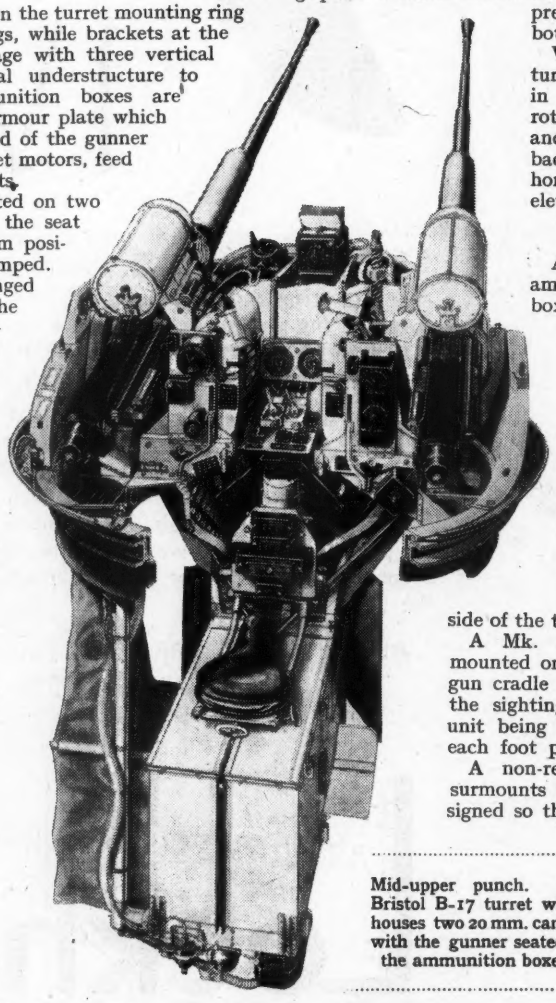
Guns are mounted in specially designed cradles, which incorporate the recoil mechanisms, and are rigidly connected by a transverse torque tube so that they move together. A vertical screw jack is rotated by the elevation motor through a reduction gear, and a slipping spring clutch between the elevation motor and the reduction gear caters for excessive momentary loads.

The run of electric cables from the airframe to the turret pass through a rotating service joint; this consists of a series of slip rings and a rotor fitted with brushes in contact with the slip rings and attached to the turret so that it rotates around the stator. The oxygen supply pipe passes into the turret through the centre of the stator and is swivel jointed at the top to allow for full turret rotation.

The main current supply from the aircraft generators is controlled by a circuit breaker in the airframe near the turret; it may be operated alternatively by press-button "stop-and-start" switches in the aircraft, or by similar switches in the turret.

Control handles are of the twin-grip type, and each is fitted with a grasp-operated master control lever which, when depressed, closes a switch in the field circuits of both generators. Gun-firing triggers are conveniently placed on each control handle connected so that, when either of them is depressed, both guns fire simultaneously. A "press-to-speak" switch is fitted on the top of the right-hand grip and a similar switch on the left-hand grip, which, when pressed, increases the speed of both turret motors.

When the control handles are turned about their vertical axis in either direction the turret rotates in the same direction, and by swinging the hand grips backwards or forwards about their horizontal axis, the guns are elevated or depressed.



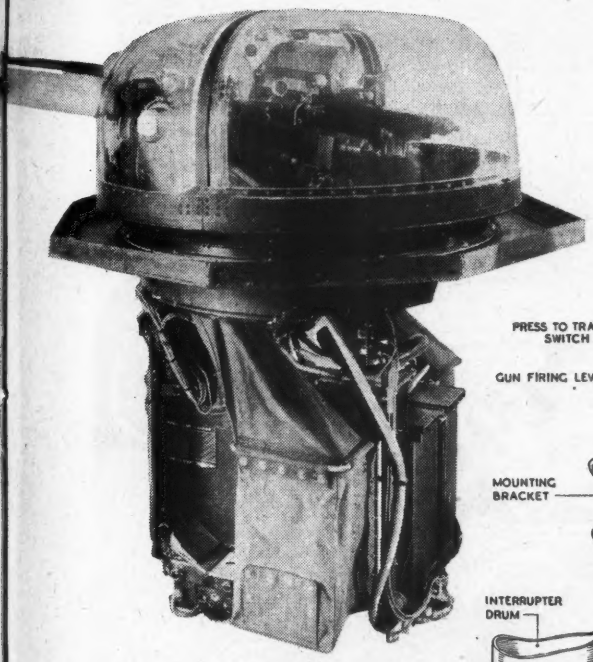
Mid-upper punch. The Bristol B-17 turret which houses two 20 mm. cannon with the gunner seated on the ammunition boxes.

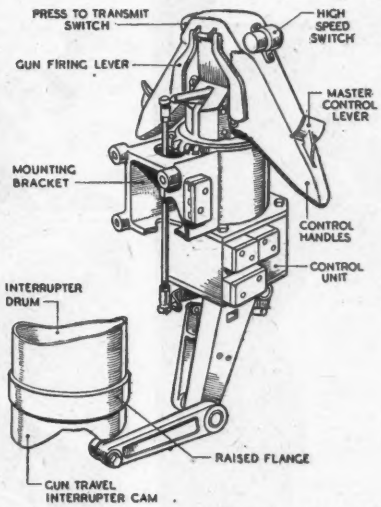
Sighting Control

Approximately 760 rounds of ammunition are carried in two boxes built into the understructure below the gunner's seat. The belts are conveyed through skeleton ducts to electrically driven feed assisters mounted behind the armour plate diaphragm on each side of the turret. Empty cartridge cases and used belt-links fall through the gun cradle mounting brackets into fixed "empties" chutes and thence into canvas bags which are slung on either side of the turret outside the gunner's legs.

A Mk. IIc gyro gunsight which is mounted on the torque tube between the gun cradle brackets has been adopted as the sighting medium, the range control unit being operated by a flap pedal on each foot plate.

A non-retractable transparent cupola surmounts the turret. This has been designed so that the after half can be jettisoned quickly in emergency and thereby provide an escape hatch. The forward half of the cupola has vertical slots through which the guns project, and these slots





(Above) The Bristol B-17 turret with cupola in place. (Right) The control pedestal of the Bristol mid-upper turret.

are closed by curved panels and draught-excluding seals.

A Boulton Paul type D turret equipped with two 0.5in. guns provides the tail armament for the Lincoln and a type F remotely controlled turret similarly equipped is used for the nose emplacement. In both types, turret actuation is hydraulic and gun firing electric, whilst in the case of the tail turret electric feed assisters for the ammunition are also employed.

Rate of fire per gun is approximately 750 rounds per minute, and the recoil is absorbed by special units fitted to the gun. Empty cartridge cases and links are ejected and discharged through a chute.

The turret is rotated by a hydraulic motor mounted on the underside of the turntable, the driving pinion engaging, through an epicycle reduction gear, an internally toothed gear ring carried on the fixed ring of the turret. Guns are elevated and depressed by a second hydraulic motor also mounted on the underside of the turntable, the driving pinion engaging, through a gear box, a torque tube which drives the two gun chassis in unison.

Power for the two motors is supplied from a hydraulic generator driven by an electric motor, both being carried on the underside of the turntable, the current from the aircraft accumulators being conducted through a slip-ring unit mounted in the base of the turret at the centre of rotation. The slip-ring unit also supplies the other electrical circuits in the turret.

Rates of the two movements, azimuthal and zenithal, are controlled by varying the output of the hydraulic generator. A control column conveniently placed for the gunner is linked to the generator, a backward movement causing the guns to elevate, and a forward movement, by reversing the direction of the output, causing the guns to depress. A movement to the right-hand side causes the turret to rotate to the right—that is, in a clockwise direction as seen looking down on the turret—and a movement to the left-hand side reverses the rotation. A combination of the two movements of the control column permits of the guns being aimed at any point within the field of fire. The full travel of the turret in azimuth is 180 deg., i.e., 90 deg. on each side of the aircraft fore-and-aft centre line, and full travel in zenith is 90 deg., i.e., 45 deg. above and below the horizontal.

A firing button is fitted on top of the control column, for electrical firing of the guns, and a gyro gunsight, with pedal control for range correction, is mounted centrally in the turret, being connected by suitable linkage to the gun chassis. Protection for the gunner is provided by armour plate mounted in the front of the turret between the two guns.

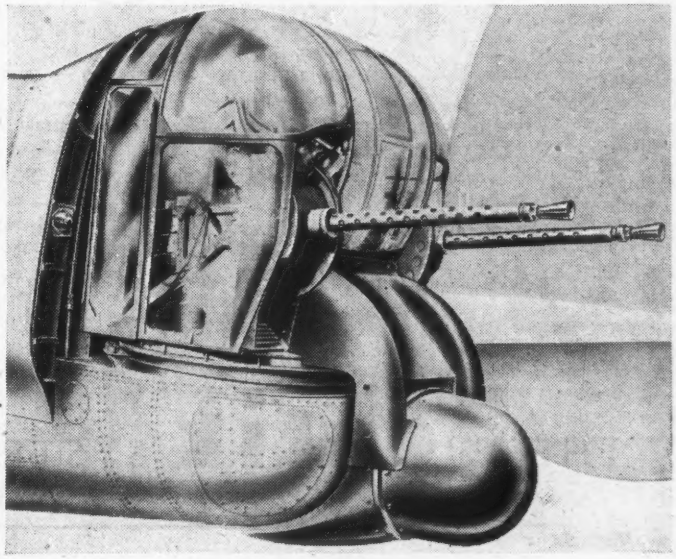
Oxygen supply for the gunner is taken from the aircraft main supply through a rotatable joint carried at the base of the slip-ring unit, and a flow indicator is mounted on the right-hand side of the control panel.

Radar Sighting

All the components above the turret-ring level are enclosed by a glazed cupola which gives the gunner the maximum possible field of vision and protection against the elements. Sliding panels for direct vision are provided in front and one at each side for conditions of bad visibility, and sliding doors at the rear of the cupola provide access.

Although not an integral part of the turret, special radar scanning equipment is accommodated beneath the turret support deck. This ingenious device radio-locates an enemy aircraft and produces a trace which is projected up to the gunsight, thus enabling the gunner to fire accurately at a target which, to him, may be invisible.

The type F turret installed in the nose of the Lincoln is designed to allow both turret and bomb-sight to be operated by the air-bomber from his position in the nose of the aircraft. The guns, ammunition boxes and power drive components of the turret are located above the level



Twin 0.5in. machine guns are fitted in the Boulton Paul D type rear turret. Sighting is by reflector sight plus radiolocation.

That's how post-war industry is working — turning war-time experience of Bostik Products to advantage. A wise move, for what Bostik Adhesives and Sealing Compounds did in war, they can do in peace. And today they are doing a difficult peace-time job right well.

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THE LINCOLN'S DEFENCE

of the mounting ring, which is immediately above the air-bomber's seat position.

Controls, sight linkage and sight extend from the turret into the bomb-aiming compartment below, and the gunner sights through the transparent nose of the aircraft whilst occupying the normal bomb-aimer's seat, which is fixed and does not rotate with the turret. The turret can be rotated to 45 deg. each side of the fore-and-aft centre line of the aircraft, and the guns can be elevated or depressed 40 deg. above or below the horizontal.

Both guns are 0.5in. Brownings, with a rate of fire of approximately 750 rounds per minute each, and an ammunition supply of 275 rounds per gun is carried in the turret.

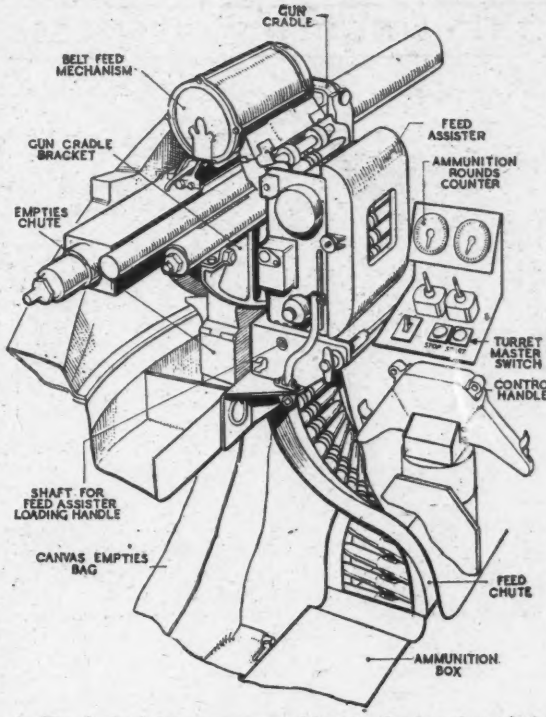
The turret structure is mounted on a ball-bearing mounting ring, the fixed ring of which is attached to the aircraft decking, and the guns are mounted parallel and close together on a central gun chassis with a special recoil damper fitted on the front of each gun. Mountings are designed to permit quick release of the guns by the action of a single lever.

Actuation

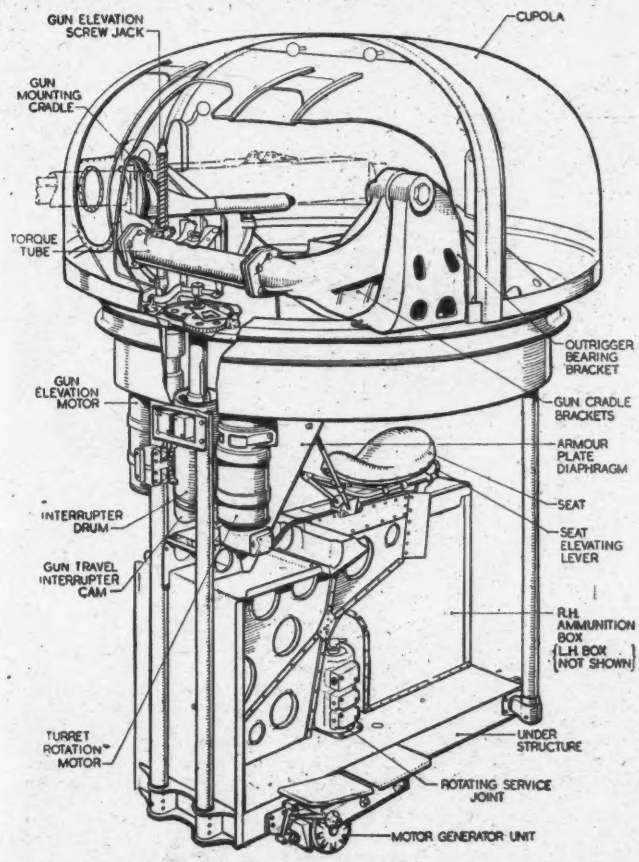
A hydraulic motor is used to supply the power for rotating the turret and a ram supplies the power for elevating and depressing the guns. Both the motor and the ram are supplied from the hydraulic generator, which functions in a similar manner to that described for the tail turret.

Each pump of the generator is connected to the turret controls, which take the form of a pair of handles connected together by links and pivotable about the vertical and horizontal axes.

To elevate and depress the guns the handles are pivoted backwards and forwards, and to rotate the turret they are pivoted to right or left, a combination of the two movements permitting the guns to be aimed at any point within the field of fire. Inter-communication, call light and oxygen equipment are all installed in the aircraft nose, so that only two power leads have to be brought into the turret, and for this purpose trailing cables extend from the fuselage to the rear of the turret.



The feed of 20 mm. ammunition to the breeches of the cannon in the Bristol mid-upper turret.



Layout of the B-17 turret showing its principal components.

Ammunition Feed

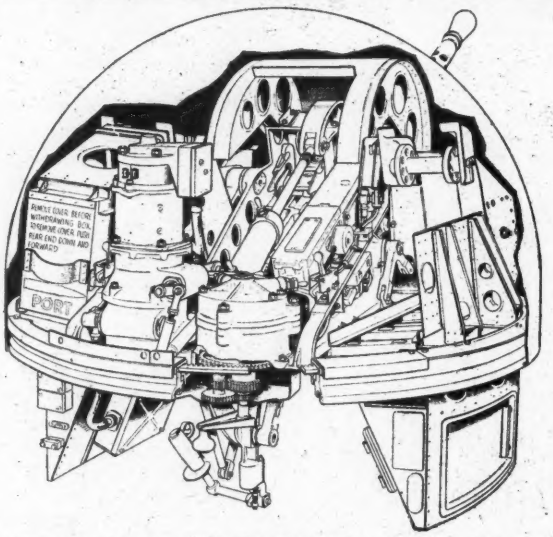
Ammunition is contained in two detachable boxes, one for each gun, located outboard of each of the two vertical members of the turret frame, and ducts are provided to guide the belts from the boxes to the sides of the gun chassis. Each of these incorporates a feed roller to allow the belt to feed smoothly from the box into the duct, and a large conical roller to twist the belt through the 90 deg. made necessary by the relative positions of boxes and guns.

Empty cartridge cases and links are ejected through apertures in the gun chassis into a conical drum attached to the underside of the cradle. The drum directs the empties through passages in the vertical members into the containers below the ring level, which are emptied through quick-release doors.

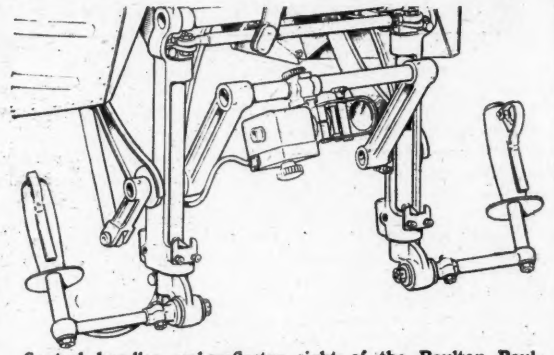
A cupola encloses the upper structure of the turret and consists of a frame built up of angle members panelled with sheet metal. Transparent panels are not necessary, as sighting and searching are done through the windows in the bomb-aimer's compartment. Small transparent sections are provided in the cupola, and the two large detachable doors are fitted at the rear for servicing purposes.

The decision to use a heavier defensive armament than that provided by rifle calibre guns

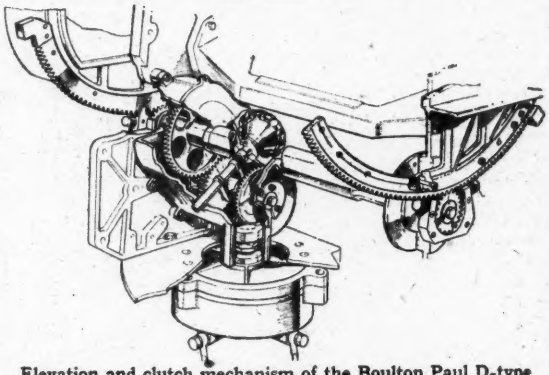
THE LINCOLN'S DEFENCE



Three quarter rear of Boulton Paul F-type turret in nose of Lincoln.



Control handles and reflector sight of the Boulton Paul front turret.



Elevation and clutch mechanism of the Boulton Paul D-type rear turret.

was taken quite early in the war, and within a short space of time prototypes of several turrets to take the heavier guns were produced. Continuous experimental work resulted in many of the initial difficulties being rapidly overcome and design layout on production turrets began.

The U.S. Army and Navy Departments were at that time contemplating the use of power turrets, and several versions of the Boulton Paul 0.303 turrets were shipped to America for experimental purposes. Additionally, after the first mock-up of the 0.5 in. turret had been produced this also was sent to the States in order to assist American firms in their production problems.

EMPIRE AIR TRAINING SCHOOLS

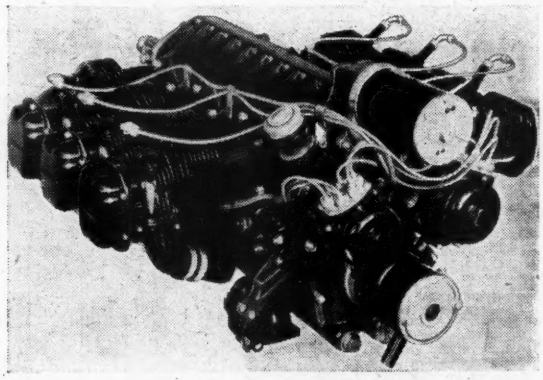
DURING the late war five training schools of Empire status were established in Britain to standardise training and methods for the R.A.F. and the Air Forces of the Empire and Dominions. These were (in addition to the Empire Central Flying School at Upavon) the schools of Flying Training at Hullavington, Test Piloting at Cranfield, Air Armament at Manby, Navigation at Shawbury, and Radio at Debden. At all these schools there are Empire and Dominion Air Force officers among the members of the directing staffs. It is, however, necessary that each school should on occasions send members of its staff to visit schools overseas and learn at first hand the training needs of the local Air Forces.

Last autumn, between October 27 and December 3, the Empire Air Armament School sent a Lancaster, named *Thor*, on a mission to the Middle East, Southern Rhodesia and South Africa. *Thor* contained all the latest armament equipment used by the R.A.F. to assist bomb aiming and air gunnery, including the gyroscopic gun-sight and the radar equipment known as A.G.L.T., which is a blind-firing device. This searches the area covered by the guns, and should an enemy aircraft within range enter the field a small green image of an aircraft appears on the gun-sight. It increases in size as the enemy approaches. The air gunner is thus shown the enemy's position and range.

Thor was also equipped with H2s to aid in demonstrating the marking and blind bombing technique employed by Bomber Command on night attacks and in conditions of 10/10ths cloud cover. In addition, the R.A.F. special automatic bomb-sight, fully stabilised in pitch and roll, was carried This exceptional sight is of the type fitted to Lancasters carrying twelve or twenty-two thousand pound bombs on many famous attacks such as that resulting in the sinking of the *Tirpitz*.

By such missions as that of the E.A.A.S. a first-hand exchange of ideas by discussion is ensured, and the important object of uniformity of Empire air training is being achieved.

FLAT SIX



This compact power unit is the new Continental A-100, the lowest powered of three new six-cylinder versions (100, 115 and 125 h.p.) of the well-known flat four of the same *marque*. Features of all three include a six-throw crankshaft; direct drive; normal aspiration; alloy heads on steel barrels; and self-adjusting hydraulic tappets. Insistence has been placed on production simplicity and on interchangeability of components, not only between the three newcomers but also with the existing four-cylinder range. Overall dimensions of all three engines are: length 40 1/16 in.; width 31 1/4 in.; and height 24 3/4 in. Dry weights are 221 lb. (100 h.p.) and 248 lb. (115 and 125 h.p.)

"Indicator" Discusses Topics of the Day

SPEED and THRUST

Coping with Modern Aeronautical Parlance : Mach Numbers and Jet Effects Explained : Cap-and-Gown versus Flesh-and-Blood

JUST at the moment I feel rather as Blondin must have felt when preparing to make his tight-rope crossing of the Niagara Falls. Or like a professor of history who has recklessly given himself the job of lecturing a class on quadratic equations, and who is aware that a very fair proportion of the people in the class know a great deal more about the subject than he does himself.

However, the knowledgeable types may now leave the room.

During the last few months I have met dozens of otherwise intelligent and worthy characters in aviation who have admitted to the possession of only the haziest notions of the meaning of Mach numbers and of all this jet thrust business. Furthermore, they have looked on these matters as being firmly and finally beyond the limits of their understanding. I confess to being only moderately informed myself, but I just don't believe that the ordinary person is incapable of grasping the essentials—and I certainly see no reason why we should always agree to being blinded by science without making at least some effort to face the light.

> *. . . . I just don't believe that the ordinary person is incapable of grasping the essentials.*
>
> *. . . . speed of sound in the atmosphere varies with temperature . . . temperature is almost the sole arbiter in the matter.*
>
> *. . . while the indicated speed is increasing, the Mach number may be dropping.*

Goodness knows the present-day citizen is all too ready to be hoodwinked and browbeaten by formulæ, and to allow himself to be pushed around by economists, legal experts and anybody else who can bluff him into a state of mathematical or verbal hypnosis. So here is the light as I see it.

I shall start with the Mach number business because, in the interests of my own personal safety, I was once forced to pay serious attention to it and, in the absence of Machmeters, to know approximately the relationship between indicated air speed, true air speed, and the speed of sound at varying heights. In those days I hadn't heard of Dr. Mach, or only vaguely so—I merely knew that strange things happened to aircraft if they were dived too enthusiastically at high altitude; I knew why these strange things happened; and I knew how to avoid them by thinking in terms of a ratio which was inexplicably labelled with the good doctor's name. We even had a list of maximum safe indicated speeds for different types while flying at different altitudes, and it was because some of these figures seemed to be strangely low in relation to dramatic figures which appeared sometimes in the newspapers that I started to take more than an immediately professional interest in the whole question.

> *. . . . 2,000 lb. of static thrust and not developing any measurable power.*
>
> *. . . . there will be no horsepower at all if there is no movement.*
>
> *. . . . increase of speed with a constant thrust is equivalent to an increase in power.*

The Mach number is, of course, the simple relationship between the speed of an aircraft and the speed of sound. If a certain type has, somewhat loosely, been given a Mach number, say, of 0.75, it means that this type can be flown with safety and under normal control up to a speed of 0.75 times that of sound—in other words, up to about 570 m.p.h. at sea level. Beyond that point shock waves start to appear here and there, with the appearance of consequent flying characteristics which may or may not make the aircraft uncomfortable or even difficult

Nowadays, the child in the kindergarten seems to know all this. He also appears to know that the calculations are complicated by the unfortunate fact that the speed of sound decreases with height and that the indicated air speed also drops away with increased height and consequently decreased pressure and in slightly varying degree according to the prevailing temperature conditions. But (and I can see Smith Minor fidgeting with embarrassment as the professor dares to give the class such all-too-well-known facts) the relationship between two variations is not by any means the same, and for one very good reason.

Contrary to prevalent belief even amongst the semi-intelligentsia in the aviation world, the speed of sound in the atmosphere varies with *temperature*. In fact, for all practical purposes it can be accepted that temperature is the sole arbiter in the matter; the colder the air the lower is the speed of sound through it.

So we have the complicated situation of an indicated air speed which drops consistently, and almost according to a formula, with increasing height and decreasing pressure, while the speed of sound falls (or not, as the case may be), in relation to a totally different set of temperature conditions. And these conditions, I may say, are very odd. Not only does the temperature vary at lower altitudes from hour to hour, but the drop is not consistent with height and it even begins to be a little warmer above 30,000ft.

Varying Ratios

The result is that, in general, we have the speed of sound falling pretty consistently during a climb up to 30,000ft., while remaining much the same, or even increasing, from 30,000ft. upwards; and an I.A.S. dropping consistently, during the climb, according to a different rule. There is, consequently, no reliable relationship between one's calculated true air speed and the speed of sound, and certainly none between one's indicated air speed and the speed of sound. In order slightly to clarify the whole situation something called "Equivalent Speed" has been devised. It will not add to the gaiety of nations if I try to calculate and explain this for different I.A.S. at different heights, so we must simply take it as read.

Without going too deeply into the various calculations involved, it will obviously not be unusual for an aircraft to run into shock-wave difficulties at height, so that it becomes, perhaps, uncontrollably nose-heavy; yet, in the course of the dive and while the indicated speed is very rapidly increasing all the time, the Mach ratio is dropping to the safety figure at which the outfit can be eased quite normally out of the dive. I use the word "ratio" advisedly, because the word "number" has come to mean an accepted maximum.

It is really quite simple. The I.A.S. is rising rapidly not because the true speed may be increasing, but because, as atmospheric pressure increases with loss of height, the gap between the I.A.S. and the T.A.S. is closing up; and, meanwhile, the speed of sound in relation to the aircraft is increasing as height is lost and as the temperature is consequently rising. At the risk of doing a little "blinding" on my own account, here are some imaginary, but

SPEED AND THRUST

(I hope) not unreasonable figures for such a set of conditions:

Heigh ft.	I.A.S. m.p.h.	T.A.S. m.p.h.	Approx. Speed of Sound m.p.h.	Mach Ratio
30,000	305	500	675	0.74
20,000	370	510	710	0.72
10,000	445	520	735	0.71
5 000	490	530	760	0.70

There have been aircraft which accelerated downhill to such a tune, or for which the shock-wave effects were so pronounced, that the Mach number "improvement" never came—or came too late and too slowly for safe recovery; so pull-out flaps or other devices had to be fitted to alter the aerodynamic conditions. My T.A.S. figures are, of course, very academic; in fact, there might be some very considerable acceleration for a start and probably a rapid slowing-up at lower levels. But the Mach number would inevitably decrease, though the indications on the A.S.I. would increase in a frightening way.

Jet Thrust

Mixed up nowadays with all this shock-wave stuff is jet propulsion and the "new" kind of power figures used with it These can cause much alarm and despondency amongst the non-technical people—not unnaturally, since such figures appear to me to be, in effect, almost as bogus as a series of diagrams of a four-dimensional continuum.

You can watch a Merlin being run up in an aircraft and say, "Ha! That miraculous product of engineering skill is developing 2,000 b h.p." Sure it is. Running at its most efficient speed and driving round a large constant-speed airscrew, it is also pushing a great mass of air about, to the discomfiture of persons, cows, insects and plants in the background. You can then move on to a jet unit and watch this being run up in another aircraft. In this case there is a blast which sears all the persons, cows, insects and plants while also pushing them over. The technician will tell you that the unit is giving 2,000 lb. of static thrust, but is not developing any measurable power.

The entire difficulty appears to be concerned with the average person's translation of the word "horse-power." The steam in a boiler is straining all the rivets and stretching all the molecules in the steel; the locomotive at full throttle against the buffers is (apart from emphasising the continued shortage of signalmen) exerting force and stretching or compressing material; and the jet unit is producing a definite weight of thrust.

But none of the three is doing work at any measurable rate—therefore they are not developing power in the academic sense. It is merely potential power.

It all began long ago when somebody decided to introduce a basis for calculations, and the horse, which had previously done our work, was used as the foundation.

Horse-power is the *rate* of doing work. Someone decided that a "standard" pony could lift, using a rope and a pulley, a weight of 33,000 lb. a distance of one foot in one minute. So a horse-power was thereafter ordained to be equivalent to 33,000 lb.-ft. per min., or 550 lb.-ft. per sec., or 375 lb.-miles per hour.

This, again, is kindergarten stuff. In the textbook, as a natural corollary, we are told that horse-power equals thrust (in lb.) multiplied by speed (in m.p.h.) and divided by 375. A few calculations will show that the higher the speed, with the same thrust, the greater is the horse-power—or the rate of doing work—and that, on the other side of the picture, there will be no horse-power at all if there is no movement. In the same way, the thrust provided will become less and less if the horse-power remains constant while the speed increases.

The beauty of the jet engine is that, given the same "ram" effect, the thrust remains substantially constant for any speed and any altitude. So, according to the text-book, while increasing speed when using the same power output results in decreasing thrust, the same increase of speed with a constant thrust is equivalent to an increase of power. Whereas 2,000 b.h.p. at 300 m.p.h. gives (making no allowance for airscrew efficiency) a thrust of 2,500 lb., the same power at 500 m.p.h. is giving only 1,500 lb. or less. On the other hand, a thrust of 2,500 lb. at 300 m.p.h. is equivalent to 2,000 b.h.p., but, at 500 m.p.h., it will be equivalent to the work of 3,300 b.h.p.

What we are, in fact, saying is that, in the last instance, 3,300 b.h.p. would be required (or that much work done) to maintain a thrust of 2,500 lb. at 500 m.p.h.

The reality is a nice balance of thrust and drag. If you have a constant thrust of 2,000 lb., then, with a particular aircraft, your maximum speed will be that at which the total drag of the entire aircraft is just 2,000 lb. The cleaner your aircraft, therefore, the more valuable is the thrust; and the higher you fly the less is the drag at any particular speed—though, unfortunately, the thrust from the jet, in real life, drops away because the unit cannot be fed with the same weight of air.

For the benefit of those who have forgotten their school-days mechanics, but who are interested in working out equivalent jet forces in terms of horse-power—and vice versa—here are the formulæ in simple terms:

$$\text{h.p.} = \frac{\text{thrust (lb.)} \times \text{m.p.h.}}{375}\ ;\ \text{thrust (lb.)} = \frac{375 \times \text{h.p.}}{\text{m.p.h.}}$$

In the second formula, on the top line, should be included an allowance for airscrew efficiency—a matter of about 0.75 at normal speeds.

I will now sit back and wait for the scuffling sounds and the rattle of sabres as the cap-and-gown boys prepare for the attack. If for nothing else, I deserve to be cut down like a dog for my criminally loose use of expressions and loose simplification of the problems.

EXPORT AMBASSADORS

IN furtherance of the overseas marketing policy of Rolls-Royce, Ltd., Mr. Ernest W. Hives, C.H., M.B.E., director and general manager of the company, is leaving England by air early in February with an itinerary which includes the Near East, India, Australia, and New Zealand, on behalf of the company's aircraft and motor car interests.

SPECIAL ENGINE TEST-REGULATIONS

IN pursuance of the statutory procedure under the Factories Act, 1937, the Minister of Labour and National Service gave notice in the London and Edinburgh *Gazettes* of Friday, January 4, 1946, that he proposes to make special regulations applying to factories where the testing of aircraft engines or of carburettors or fuel pumps for aircraft is carried on.

Copies of the draft special regulations, which are entitled the Factories (Testing of Aircraft Engines, Carburettors and other Accessories) Special Regulations, may be obtained from H.M. Stationery Office or through any bookseller, and any objections to the draft have to be sent to the Ministry on or before February 9, 1946.

The special regulations are intended to replace the Factories (Testing of Aircraft Engines, Carburettors and other Accessories) Order, 1944, S.R. & O., 1944, No. 495, which was made under Regulation 60 of the Defence (General) Regulations, 1939, and is therefore of only temporary duration.

New Year Honours

(*Concluded from page 69*)

and Industrial Research; Cdr. A. D. Pickup, O.C., No. 5 (Training) Ferry Pool, A.T.A.; J. B. Prior, M.A.P. Resident Technical Officer, Vickers-Armstrongs, Ltd.

R. B. Pullin, Managing Director, R. B. Pullin and Co.; J. A. Ratcliffe, Supt., Telecommunications Research Estab., M.A.P.; J. H. Robson, Director-in-Charge, Propeller and Engine Repair Aux., B.O.A.C.; F/O. R. T. Shepherd, R.A.F.O., Chief Test Pilot, Rolls-Royce, Ltd.

H. W. Sidwell, Gen. Manager, Air Service Training, Ltd.; A. H. Smith, Prin. Scientific Officer, Air Ministry; H. V. Snook, Chief Eng., Bomber Command, R.A.F.; J. Summers, Chief Test Pilot, Vickers-Armstrongs, Ltd.; T. R. Thomas, Sect. Air Registration Board; Wing Cdr. L. C. Wynne-Tyson, R.A.F. (Retd.), Dept. Gen. Manager, Home Canteen Service, N.A.A.F.I.; J. H. Wears, Works Manager, English Electric Co., Ltd.; A. Whitaker, Chief Eng. (Physicist), Nash and Thompson; Cdr. T. H. N. Whitehurst, O.C., No. 6 Ferry Pool, A.T.A.; Cdr. S. B Yardley, O.C., No. 16 Ferry Pool, A.T.A.

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Accident Analysis

Transport Command's Trooping Record : A Comparison with Pre-war Civil Aviation

R.A.F. TRANSPORT COMMAND'S accident rate during 1945 amounted to only one passenger killed for every forty million passenger miles flown on the Command's scheduled services. This figure was disclosed recently by a senior R.A.F. officer, who compared the Transport Command figures with those for civil aviation during the five years, 1934 to 1938. The comparison can be seen in the accompanying table.

Unfortunately, the accident rate for trooping aircraft was much higher than that for the scheduled services and reached one passenger fatality for every three million miles flown. This high figure is entirely the result of four unfortunate crashes which occurred in rapid succession in the very early days of trooping, and, happily, there has been no recurrence of such accidents.

Difficult Comparison

The comparison of the Command's accident figures with those for pre-war civil aviation is not entirely a fair one. On the one hand, civil aviation during that pre-war period had expanded steadily over some fourteen years, and the increase in operations amounted to only 15 per cent. each year. On the other hand, Transport Command was chiefly built up during 2½ years of war, at a time when all priorities of equipment and manning were the perquisite of the operational theatres. Nevertheless, a 100 per cent. increase in operations per year was accomplished and, as the figures show, the fatality rate for a world-wide network of routine aircraft was very low.

When considering the trooping fatality figure, it should be borne in mind that trooping by air was originally an operational commitment and that it was, to some extent, inevitable that crews and aircraft were used which were intended primarily for operational flying; secondly, that large-scale trooping by air to the Far East was reversed after VJ day to become repatriation by air; thirdly, that flights such as the U.K.-India trip were taking place over a distance of 5,000 miles each way and encountering extremes of weather and climate.

Now the position has changed. Air crews receive extra training specifically for passenger work and careful selection of the most suitable crews is now possible. In addition, a great improvement in the organisation of the routes as a whole has been made possible by the priority of men and material given to the Command.

Further, every effort has been made to provide improved navigational facilities throughout the trunk routes. Since the cessation of hostilities in Europe more equipment has naturally become available, and crews now have the advantage of many navigational aids, including Gee. Although at the moment the Gee chain does not cover the entire route to India, this is being remedied as quickly as possible.

Up-to-Date Weather News

Meteorological facilities, too, are excellent. Apart from the normal Air Ministry meteorological service, Transport Command has its own met. flight and also receives constant weather reports from its aircraft in flight. This enables the latest meteorological information to be given to pilots, not only at their final briefing before flight, but also at regular intervals whilst in the air by means of broadcasts from stations along the routes.

All aircraft are most carefully controlled during flight. An organisation known as Area Control supervises all aircraft throughout their journeys, each individual control being entirely responsible for the safety of aircraft within its area. It is essentially a long-range control and it operates until aircraft are within 30 minutes' flying time of their next port of call. At this stage, a local airfield organisation known as Approach Control takes over. Approach Control brings the aircraft to the immediate vicinity of the airfield when yet a third control—Airfield Control—takes over and gives all the final instructions for landing and sees the aircraft safely to the ground.

The Release Problem

There have been many references from time to time in the Press to transport aircraft accidents, and it is frequently assumed that all such aircraft must belong to Transport Command. This, of course, is not the case. It must be remembered that there are many large-scale operators of transport aircraft, and, in addition, the transportation of troops by air is being undertaken not only by Transport Command but also by Bomber, and in certain instances, Coastal Command as well. It is emphasised, therefore, that the accompanying figures cover only Transport Command's trooping and scheduled services.

Naturally, Transport Command still has a number of headaches, notably that caused by the acceleration of the release scheme. There is little doubt that the loss of experienced men under the release scheme has had the effect of slowing down the trooping programme during the last few weeks, but in effect this is a good sign, for it demonstrates that Transport Command is not willing to carry out its operations without first-class men and materials. In this it will undoubtedly have the wholehearted support of public opinion.

One cannot help wondering what will be the ultimate result of the rapid loss of so many valuable men from Transport Command under the release scheme. It is clear that the dispersal, upon release, of large numbers of "four-engine" pilots, who have had long and expensive training and unusually extensive night flying experience, is not only a serious loss to Transport Command but may well prove a serious loss to the future of civil aviation.

	Millions of Aircraft Miles	Millions of Passenger Miles	Total of Fatal Accidents to Aircraft	Total of Fatal Accidents to Passengers	Fatal Accidents to Aircraft per 10 million Miles	Fatal Accidents to Passengers per 100 Million Miles	No. of Passenger Miles Flown per Passenger Fatality
Civil Aviation 1934–1938 (Five Years)							
Belgium	7.0	—	5	—	6.9	—	—
Holland	14.8	—	4	—	2.7	—	—
France	30.9	—	11	—	3.6	—	—
Switzerland ...	3.6	—	1	—	2.8	—	—
Sweden	4.1	—	1	—	2.4	—	—
U.S.A.	294.7	—	34	—	1.15	—	—
Britain	46.6	218.8	23	49	4.9	22.4	4,400,000*
Transport Command (1945)							
Scheduled Services	62	593.0	4	15	0.65	2.5	40,000,000
Trooping Services	13	284.0	4	94	3.1	33.1	3,000,000
Scheduled Services and Trooping Combined ...	75	877.0	8	109	1.1	12.4	8,000,000

* Taking the British Civil Aviation figures year by year from 1934-38, the best accident rate recorded was in 1937 when the figure was 9,900,000 passenger miles per passenger fatality. The worst figure was for 1934 at 3,200,000 million passenger miles per passenger fatality.

Air, Land and Sea Warfare

Sir Arthur Tedder on the Strategic Lessons of the World War

GENERAL SIR HASTINGS ISMAY, K.C.B., D.S.O., took the chair at the Royal United Service Institution on January 9th when Marshal of the Royal Air Force Sir Arthur Tedder, G.C.B. (soon to be known by a still more august title) delivered a lecture on "Air, Land and Sea Warfare." General Ismay, with his experience as Chief of Staff to the Minister of Defence, was a very suitable chairman for a lecture which laid heavy stress on the need for all three Services to work together.

Sir Arthur began by explaining that he had not written his lecture as Chief of the Air Staff, but as the recent Deputy Supreme Commander under General Eisenhower, and the views which he would express were his personal opinions. He mentioned that after the San Francisco Conference Field Marshal Smuts had described the peace at which all were aiming as "Peace with Teeth." Sir Arthur said that the teeth must be sound. We must analyse the lessons of the late war, and dig out the underlying truth. We must ask ourselves whether our national war effort had been employed in the most economical way, and also ask why the Germans lost the war. By economy he meant efficiency, not doing things on the cheap. A nation at war was like a boxer, who must have the right muscles developed so that he gets each punch home with the maximum effect and the minimum effort. In the first great war we had started with a slogan of "Business as usual," but we found it did not pay, and gave it up. In the recent war Germany tried to maintain "Business as usual" in some respects up to 1944.

Five Separate Wars

Sir Arthur said that there was one war of production, fought in the factories; another of civil defence; another on the sea; another on land; and another in the air. Each of these had its own unity. He explained that all these combined to create one unity of national effort.

He was still of the opinion that there was such a thing as air warfare as apart from sea warfare and land warfare, but he did not fully develop that thesis. He said that the Germans never got their land and sea forces closely knit. They used to boast about their *Luftwaffe*, but they never looked on it as anything but an ancillary to their army. In the early days the *Luftwaffe* could intervene in a land battle without first having to win the air battle. At the end the *Luftwaffe* showed up as not having been properly trained or equipped.

It might be necessary at the beginning of a campaign for all sides of an Air Force to work together to gain air superiority. He asked his audience to contrast the early days when the British sea convoys had to sneak along the coast with the final days when the seas round Britain were thronged with craft of all sorts in great numbers. That was because we had gained air superiority.

Sir Arthur said that he considered the outstanding features of air power were flexibility and the power of concentrating. Air power in penny packets was worse than useless. But air unity was not exclusive; operations in the three elements were interdependent.

Old and New Standards

To illustrate his point he recounted the campaign of Crete. After our defeat in Greece Crete lay in a semi-circle of enemy airfields. Our few airfields (both in Greece and in Crete) had no possibility of dispersal, owing to lack of engineers, and no defence, owing to lack of guns. By the old standards we held command of the seas; but 80 per cent. of the reinforcements and supplies from Egypt had to turn back; 10 per cent. were sunk, and only 10 per cent. got through. That was because we did not command the air. So we learnt our lesson; we must have air superiority in quantity as well as in quality. We must be frank, said Sir Arthur repeatedly. It was no use having a good fleet or a good army without air power. Gradually the need of a balance of forces was realised. Then the land war in the Mediterranean became a battle for airfields and we won it.

Only with mutual faith and knowledge could you get the three unities working as one. It was essential that all commanders should know what the other two Services were doing. In the air we constantly had to choose between a faggot, which was hard to break, and a number of single sticks, each of which was weak. We stuck to the faggots. Mutual faith and understanding brought one to personalities. One must have men who will fit together. We owed more than we could realise to General Eisenhower. To achieve mutual faith one must be ruthless; give men a little time to get to work together, but if some individuals could not do it, they must be got rid of.

Sir Arthur turned back to the question of mistakes. He pointed out that in 1940 the Germans could not stop the evacuation from Dunkirk or face an invasion of England, though the land defenders were mostly armed with shot-guns and pikes; while in 1943 there was no German "Dunkirk" from Tunisia, and in 1944 the Germans, despite years of preparation, could not stop the Allies from invading the Continent.

Now we had to face the future. In his opinion, said Sir Arthur, the key words for the future were flexibility and speed. The future lay, not with a slow-growing Goliath, but with David.

THE LOCKHEED SATURN

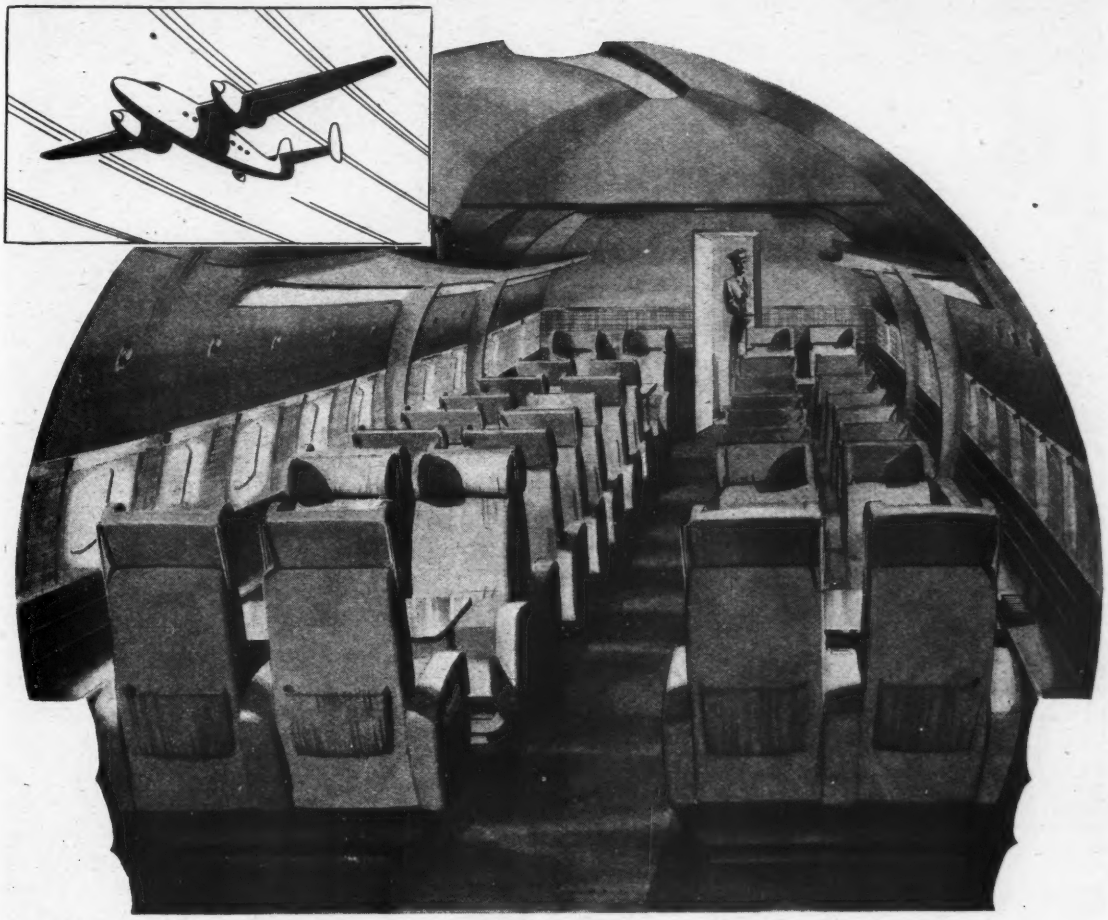
SOME preliminary details of the Lockheed Saturn are now available. This is a high-wing, feeder-line aircraft, fitted with two 600 h.p. engines—probably Continental G.R.9-As. Particular attention has been paid to ease of maintenance, and the whole machine appears to be a very well thought-out and practical job.

The gross weight is 14,000 lb., the empty weight is 9,634 lb., and the operating weight, empty, 10,200 lb. There are 14 seats with a total cargo space of 162 cu. ft. The fuel capacity is 492 U.S. gallons with 20 U.S. gallons of oil. Estimated performance is as follows:—

Cruising speeds at 60 per cent power:—	
At sea level	189 m.p.h.
,, 5,000ft.	198 m.p.h.
,, 10,000ft.	207 m.p.h.
Range (with 45 minute reserve) at 60 per cent power:—	
Payload—3,120 lb.	250 miles
,, —2,740 lb.	500 miles
Climb at normal rated power:—	
Sea level—two engines	1,460 ft./min.
Sea level—one engine	400 ft./min.
5,000ft.—two engines	1,440 ft./min.
5,000ft.—one engine	370 ft./min.
Ceiling at normal rated power:—	
Two-engine service ceiling	26,100ft.
One engine	15,000ft.
Take-off and landing run:—	
Minimum take-off	1,000ft.
Take-off over 50ft. obstacle	1,870ft.
Landing over 50ft. obstacle	1,790ft.

METEOROLOGICAL BROADCASTS

TRANSMITTING, as in pre-war years, from Borough Hill, the Air Ministry is now giving a day-long series of weather broadcasts on a frequency of 245 kc/s (1,224 metres). Starting at 0700 G.M.T. in winter, the broadcast includes navigational warnings, general weather forecasts and "actuals" from forty different airfields. They are continuous, each series being completed in the hour.



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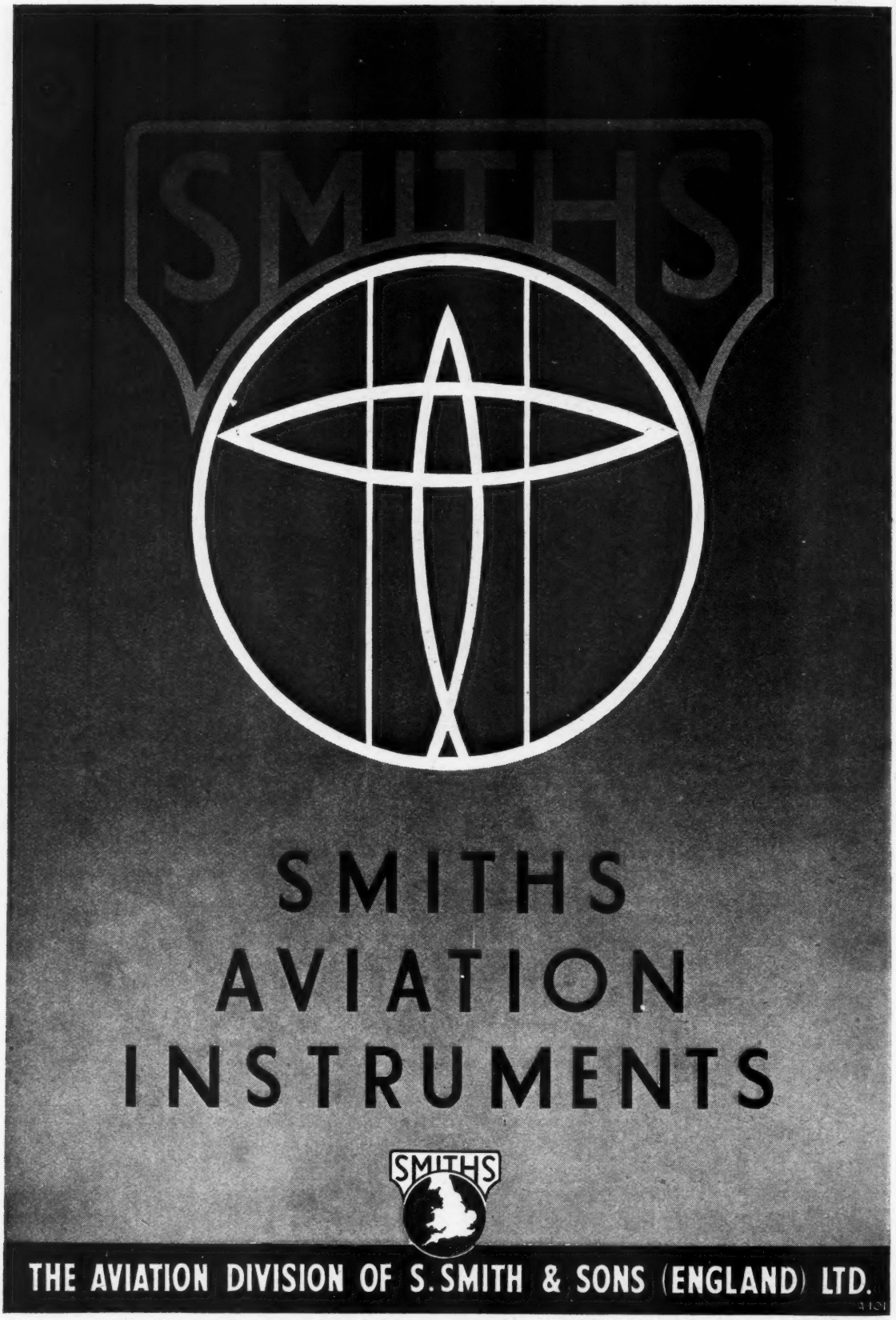
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ORDER OF THE BRITISH EMPIRE

(*Conclusion of First List from page 45*)

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Sqn. Ldr. A. C. Holmes, R.C.A.F.; Sqn Ldr. J. H. Hooke, R.A.A.F.; Sqn. Ldr. W. L. James, R.A.F.V.R.; Sqn. Ldr. A. M. Jamieson, R.A.F.V.R.; Sqn. Ldr. B. B. Joseph, R.A.F.V.R.; Sqn. Ldr. R. J. Keir, R.A.F.V.R.; Sqn. Ldr. V. P. Key, R.A.F.V.R.; Sqn. Ldr. G. Leitch, R.A.F.; Sqn. Ldr. E. W. B. Lewis, R.A.F.V.R.; Sqn. Ldr. A. R. F. Martin, R.A.F.V.R.; Sqn. Ldr. W. H. Marwood, R.A.F.V.R.; Sqn. Ldr. E. T. McCabe, R.A.F.; Sqn. Ldr. F. D. MacCarthy, R.A.F.V.R.; Sqn. Ldr. H. T. Macauley, R.A.F.V.R.; Sqn. Ldr. D. McFarlane, R.A.F.; Sqn. Ldr. H. J. Miller, R.N.Z.A.F.; Sqn. Ldr. G. D. Mills, R.A.F.

Sqn. Ldr. E. F. Ockenden, R.A.F.; Sqn. Ldr. J. R. Oliver, R.A.F.; Sqn. Ldr. W. J. Osborne, R.C.A.F.; Sqn. Ldr. A. M. Paterson, R.A.F.; Sqn. Ldr. S. Payne, R.A.F.; Sqn. Ldr. R. J. Robinson, R.A.F.; Sqn. Ldr. A. A. Roissetter, R.A.F.; Sqn. Ldr. H. F. Ruston, R.A.F.O.; Sqn. Ldr. E. H. Sharp, R.A.F.V.R.; Sqn. Ldr. H. A. Shewan, R.A.F.V.R.; Sqn. Ldr R. D. Sheardown, R.A.F.V.R.; Sqn. Ldr. J. R. Sherborne, R.A.F.V.R.

Sqn. Ldr. N. B. Sherwell, R.A.F.V.R.; Sqn. Ldr M. M. Shrinagesh, R.I.A.F.; Sqn. Ldr. B. B. Smith, R.A.F.V.R.; Sqn Ldr. A. Stephenson, R.A.F.V.R.; Sqn. Ldr. W. L Stevenson, R.A.F.V.R.; Sqn. Ldr. J. M. D. Symons, R.A.F.V.R.; Sqn. Ldr. H. Tee, R.A.F.V.R; Sqn. Ldr. D. V. H. Thomas, R.A.F.; Sqn. Ldr. S. A. Thomson, R.A.F.V.R.; Sqn. Ldr. C. R. Topham, R.A.F.V.R.; Sqn. Ldr. J. D. Urquhart, R.A.F.V.R.; Sqn. Ldr. A. F. Ward, R.A.F.; Sqn. Ldr. R. D. Watson, R.A.F.V.R.; Sqn. Ldr. T. D Weatherhead, R.A.F.V.R.; Sqn. Ldr. G. H. Wiles, R.A.F.; Sqn Ldr R. S. F. Williams, R.A.F.; Sqn. Ldr. A. C Woolf, R.A.F.V.R.; Sqn. Ldr. O. L. Yelland, R.A.F.V.R.; the Rev. C. G. McKenzie, R.A.F.V.R.; the Rev. J. W. Nowers, R.A.F.V.R.; Group Off. B. C. Beecroft, W.A.A.F.; Wing Off. E. C. Bather, W.A.A.F.; Wing Off. C. M. Spafford, W.A.A.F.; Wing Off. N. M. Salmon, W.A.A.F.; Sqn Off. K. I. Connal, W.A.A.F.; Sqn. Off. M. Goldsborough, W.A.A.F.; Sqn. Off. N. M. C. Holland, W.A.A.F.; Sqn. Off. B. R. Leighton, W.A.A.F.

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C.B.E.

W. W. Burkett, Asst Sec., Min. Civil Aviation; P. Cohen, Dep. Director of Accounts, Air Min.; J. C. A. Doherty, Director of Works II, Air Min.

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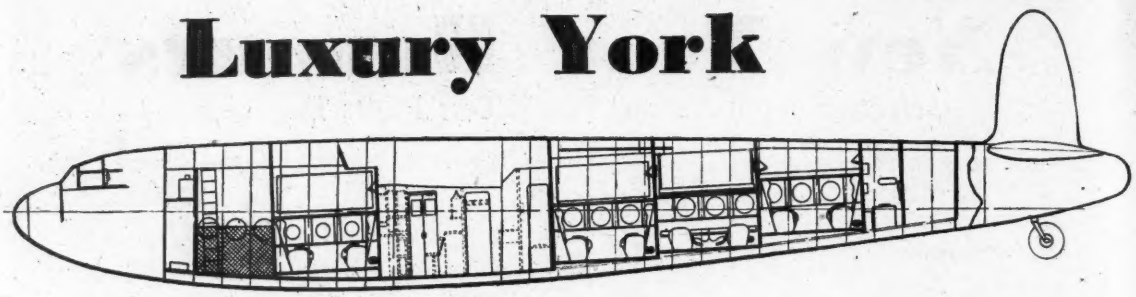
Luxury York

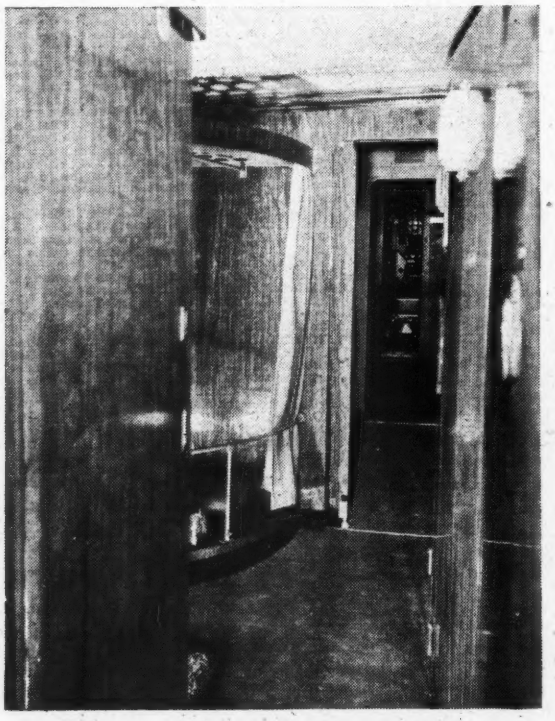


Modified Version of Well-known Transport : Special Furnishing and Layout by Air Service Training

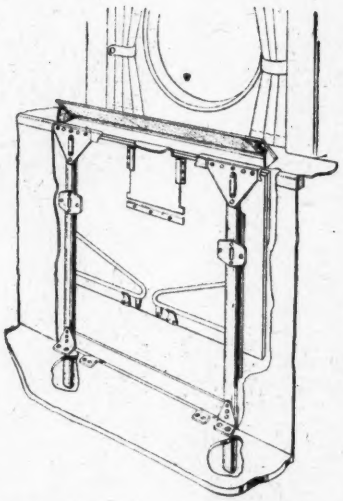
ALTHOUGH intended for normal use on the India run and not to be considered as a special aircraft laid out for charter or other trips, an Avro York which has recently been modified by Air Service Training has a number of interesting features.

This special version has been arranged to accommodate sixteen passengers by day or fourteen by night, in more than usual comfort, and with better conditions for long-period non-stop travel. Whereas the standard York has its passenger accommodation arranged more or less equally fore and aft of the small entrance lobby, with the galley and main luggage hold at the rear, the A.S.T. York has an expanded and specially furnished centre-section area, taking in the galley and provided with a small lounge as well as lavatories and dressing-rooms. Freight is carried in a forward compartment with a total capacity of 176 cu. ft., and the crew's quarters have been extended to provide a necessary "rest" position.

This layout means, in effect, that four passengers are accommodated forward of the large lobby, while the after part of the fuselage is divided into three separate compartments each, accommodating four passengers by day. In sleeper form the rearmost apartment, which is naturally slightly less deep than the others, has bunks for only two passengers. In addition to the two centre-section dressing-rooms and toilets, there is a third dressing-room abaft the rear passenger compartment.



In the special York, looking forward from the "foyer."



How the folding tables recede into the cabin wall below the window ledges.

A two-feet-wide passage-way runs through the centre of the aircraft, the various compartments being divided by bulkheads with sliding doors. This passage-way continues forward to the control cabin, with the freight compartment holds on either side.

In order to provide even more space for the passengers, the folding table between each pair of chairs can be retracted below the window line so as to disappear from view, and even when in use the supports have been designed to give unobstructed knee-room. The upper bunks fold upwards flush with (and actually forming) the cabin side between the windows and the roof, with sufficient space between the bunk structure and the outer skin for the mattresses and bed linen to be stowed. The seat "packs," of course, form the mattress for the lower bunk, which is made up from the seats.

There are two emergency exits, one of which, with a fixed ladder, is in the roof of the freight compartment. The second exit is in the roof between the two cabins immediately abaft the centre-section, and the ladder to this exit is concealed between the inner roof and the aircraft's skin. There is a small passengers' luggage compartment, with a separate outside loading hatch, in the extreme tail section.

The main interior colour scheme of the A.S.T. York is worked out on a basis of polished Indian grey wood, blue carpeting and upholstery, with cream walls and roofing. All the partitions are formed of ply sheets separated by a honeycombed ply formation. The reading lamps for each passenger are flush-fitting and arranged for correct light distribution, and there is one general roof light in the centre of each compartment.

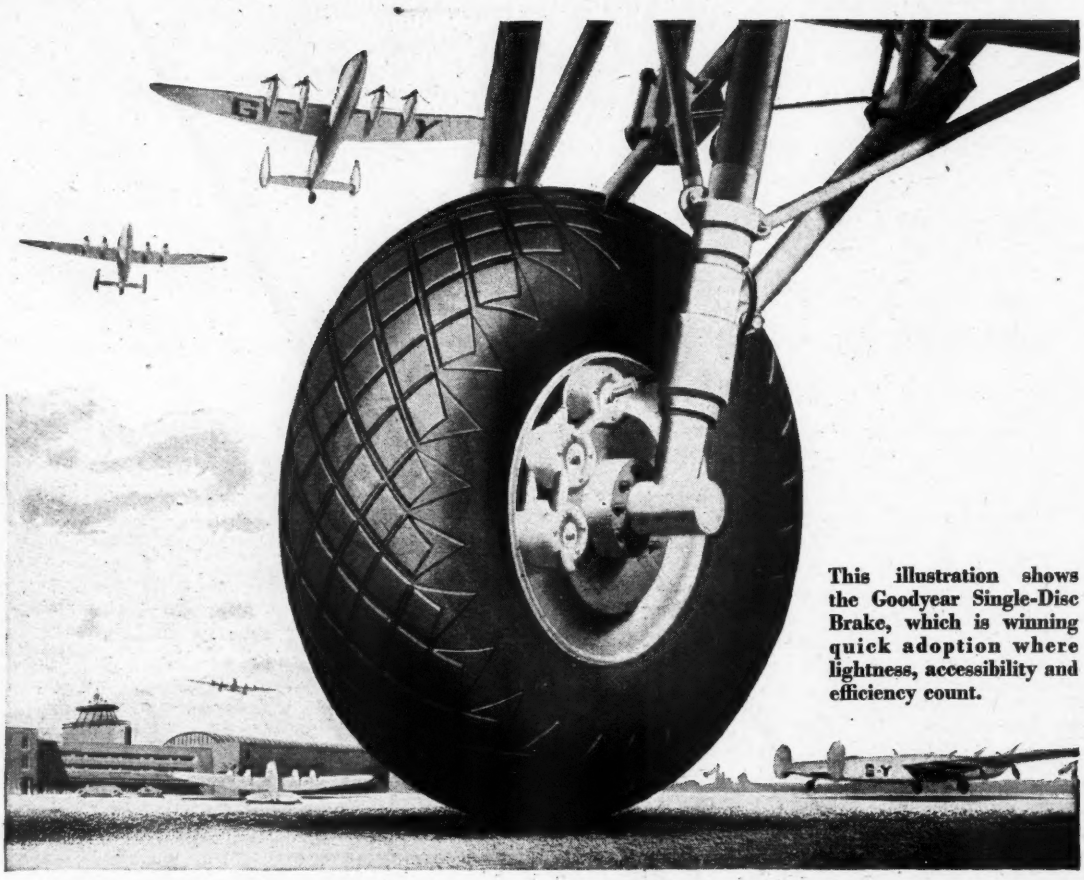
A new world record

606 m.p.h

GLOSTER METEOR

(ROLLS ROYCE DERWENT ENGINES)

GLOSTER AIRCRAFT, BRANCH OF HAWKER SIDDELEY AIRCRAFT CO., LTD.



This illustration shows the Goodyear Single-Disc Brake, which is winning quick adoption where lightness, accessibility and efficiency count.

To be airborne, they needed air . . .

Twenty-five years ago, when Goodyear were pioneering the Giant Pneumatic Tyre, the aircraft industry was in its infancy. Both grew to swift maturity. Today the world's transport moves *over* the earth on Giant Pneumatic Tyres; the world's aircraft move *off* the earth — and land on to it again — on giant, airfilled tyres which are a direct development of the original Goodyear Giant Pneumatic. In every other aspect of aeronautics, too, Goodyear have marched side by side with the growth of the industry, until today, wherever there are planes, there you will find the name Goodyear, on a wide variety of plane parts, from a tyre to the complete aircraft itself. This experience is available to all Aircraft Manufacturers and Operators, who are invited to consult us on all matters relating to Tyres, Wheels, Brakes and other accessories listed in the panel on the right.

OTHER PRODUCTS MANUFACTURED BY GOODYEAR

HOSE
SMALL BORE HYDRAULIC
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PAINT SPRAY AND SOLVENT
PNEUMATIC TOOL
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SANDBLAST
(Special types on application)

BELTS
ENDLESS CORD FLAT
E.C. "V"
FLAT TRANSMISSION
CONVEYOR

GOODYEAR

THE GOODYEAR TYRE & RUBBER COMPANY (GT. BRITAIN) LTD., AVIATION DEPT., WOLVERHAMPTON

CIVIL AVIATION NEWS

AIRFIELD CONTROL

TWO special mobile control vans have been completed for the Ministry of Civil Aviation. They are to be used at Hurn and Speke, with the object of finding out the most suitable equipment for a van of this kind. Experiments will be carried out at the airports to decide what constitutes the best layout and what equipment is needed, and it is hoped eventually to develop a standardised control van based on the results of these experiments.

NEW CIVIL AVIATION POST

WITH the acceptance by the present D.G.C.A., Sir William Hildred, of the post of Director-General of the International Air Transport Association, his place is being filled by Sir Henry Self. Sir Henry's rank will be that of Permanent Secretary of the Ministry of Civil Aviation, and he will take up his duties after the Bermuda discussions have been concluded. He has recently been chairman of the British Commonwealth Supply Committee and was in charge of the mission to the U.S. and Canada, 1940, a mission from which the British Air Commission later emerged.

FIRST PRODUCTION TUDOR

BY the time this issue of *Flight* appears it is likely that the first Avro production Tudor I for B.O.A.C. will have made its test flight. Although, as laid out for B.O.A.C., the Tudor I is a luxurious twelve-passenger aircraft for the Atlantic run, in other less fully equipped forms the Tudor can comfortably carry twenty-four "seated" passengers and more than 2,500 lb. of freight on the crossing. In this form, its maximum range is 3,630 miles at 178 m.p.h., or, at 230 m.p.h., 3,470 miles in still air.

Meanwhile the prototype Tudor II, for heavy-load shorter-range operations, is coming along well and should be flying within the next two months. Unofficially, it is understood that British South American Airways are interested in this type as a supplement in due course to the Lancastrians.

THE ANGLO-U.S. TALKS

ON January 15th a civil aviation conference between the U.S. and Britain was due to start in Bermuda. The purpose of the conversations, which are on an "official" level, will be that of examining outstanding civil aviation matters including, perhaps, those concerning Atlantic and other fare rates. In consequence of the fact that the conference has been called, the U.S. Government recently vetoed such rate discussions at the recently opened International Air Transport Association conference in New York.

At the Bermuda Conference the British delegation includes Sir William Hildred and Mr. L. J. Dunnett, of the Ministry of Civil Aviation; Mr. N. J. A. Cheetham, of the Foreign Office; Major J. R. McCrindle, of B.O.A.C., who will act as adviser to the British delegation; Sir Henry Self, the new Permanent Secretary of the Ministry of Civil Aviation; and Mr. Peter Masefield, the British Civil Air Attaché in Washington.

The main questions being raised at the conference are those concerning the use of American leased bases in Bermuda, Newfoundland and the West Indies, and the commercial use of American leased bases on British soil.

COMFORT VERSUS COST

AMERICAN AIRLINES are to use two versions of the C-54 or Skymaster—a 60-seater model for their domestic services and a 34-seater for overseas. This brings up the much argued question as to how many people you can cram into an aircraft, with the consequent increase in discomfort, and at what point does the miserable passenger object.

Obviously, the question of fares comes into it. Some airlines seem to feel certain that if you can make the fare low enough, people will not object to sitting up all night in some discomfort and certain boredom, if they can get to Europe inside twelve hours at a cheap rate. The belief that a very low-priced, uncomfortable, but rapid trip to London or Paris would be popular is strong in the States.

The same airline company is carrying out an investigation of the possible applications of radar to commercial air transport. They are already using V.H.F. experimentally between New York and Chicago, as are some of the other airlines. It seems likely that V.H.F. will come into general use in the U.S. very rapidly. Any pilot who has had experience of cross-country flying in the States and the severe static conditions which often make present wireless communications almost useless will be glad to see it standardised.

The U.S. Airworthiness Requirements on Design Speeds are being reconsidered, as many of the new transport aircraft at present under construction have such high speeds that the present relationships of designed dive speed, designed maximum permissible speed and designed cruising speed are such that aircraft like the Republic Rainbow cannot take advantage of their high-altitude performance.

A QUARTER OF A CENTURY

LAST year the Netherlands airline company, K.L.M., completed twenty-five years of air operations from this country, and during nearly all of this period Capt. H. Spry Leverton, O.B.E., O.O.N., has been their manager in this country. He left Air Transport and Travel to join K.L.M. in January, 1921, and his present position with the company is that of Traffic Director for England.

PACIFIC SERVICE

IT is more than possible that next month a Pacific service, operated by Qantas Empire Airways, may be started to replace the R.A.F. Transport Command service which was discontinued on December 1st. The terminal on the American continent has not yet been selected, and may be either Vancouver or San Francisco, but the route to be flown will be via Auckland, Fiji, Canton Island, Honolulu and San Diego. Liberators will be used, and the frequency, for a start, will be once weekly in each direction. It has been suggested in Australia that the Liberators at present being used on the Perth-Colombo run might be diverted for use on the Pacific.

AMERICA—SOUTH AFRICA DIRECT?

SOME time ago Pan American Airways put in an application for permission to operate an exclusive service from the United States to South Africa. In consequence, five American transport companies lodged an appeal with the Civil Aeronautics Board against this body's favourable recommendation. It is not expected that the C.A.B.'s final decision on the matter will be announced much before the end of February. An interesting point is that one of the "appealing" concerns is the United Nations Airships Company, which, we hear unofficially, proposes to run a service with rigid airships to Bombay, via Brazil, South Africa and Kenya.

INDIAN NATIONAL EXTENSIONS

ON the first day of the New Year two new services were started by Indian National Airways, the first between Delhi and Calcutta, and the second from Delhi to Karachi. The Calcutta run is made via Cawnpore and Allahabad, while Jodhpur is a stopping-point on the Karachi run. These are daily services; a thrice-weekly service has also been opened between Delhi, Lahore, Chaklala and Peshawar. Variants of the Douglas DC-3 will be used.

I.N.A. at present have six Douglas DC-3s, one D.H. Rapide and three Beechcraft Travellers, with a number of aircraft on loan, bringing the total to twenty-seven.

But the company have recently purchased six DC-3s from the U.S. Liquidation Commission, and these should be ready for operation this month. In addition, an order has been placed for six Vickers Vikings and two Bristol Wayfarers.

The Government of India propose to organise daily services between all the large cities. These services will be allotted by an Air Transport Licensing Board which will come into being on October 1st, 1946.

BROOKLANDS' FUTURE

THE sale of Brooklands to Vickers-Armstrongs, Ltd., was approved at a general meeting of Brooklands (Weybridge), Ltd., on January 7th. This means, of course, that the track itself will not become available again for motor racing.

The position with regard to the airfield, however, is not at present clear. Since 1911, flying schools have functioned almost continuously at Brooklands. During the war years 1914-1918, the R.F.C. took Brooklands over completely, but immediately after the war the Henderson School of Flying was formed, which subsequently became the Brooklands School of Flying under the direction of H. Duncan Davis. It is to be hoped that Brooklands' long connection with civil aviation is not now to be severed abruptly.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

R.A.F. SLANG

Who Tore Off the First Strip ?

A FRIEND who is compiling a glossary of R.A.F. slang is anxious to track down the derivation of "tearing off a strip." I have offered him my own theory, but it would be interesting to know if other readers have encountered the phrase at any even earlier date.

In the middle of 1940 I had a Wing Commander whose favourite threat was: "I'll have you on a strip of carpet." In the course of a few weeks this became "I'll have you on a *narrow* strip of carpet, then "I'll tear you off a narrow strip of carpet," and finally "I'll tear you off a strip." I am wondering if this was, indeed, the birth of this remarkable phrase.

It would be equally interesting to try to track down the origin of equally popular expressions, such as "gen," "to bind," "clueless," and so forth. W. H. BROWN.

LIGHT AIRCRAFT

Only One Briton to Challenge U.S. Types

THOSE who have the future of British light aircraft at heart can hardly fail to have noticed that whereas a score of American firms are advertising a wide range of attractive models in the 65 to 125 h.p. classes, there is still no sign of any serious competition from the British manufacturer in this field with the solitary exception of the Taylorcraft-Auster.

I have been told that British aircraft firms are only allowed to make these light types if they export something like 80 per cent. of their output, and if this be true then it might well be the explanation. Frankly, we have never been able seriously to compete with the U.S. in this particular field, and it would appear the Government is determined that we never shall. The number of overseas purchasers who will pay about twice as much for a British light aircraft as they would have to pay for an American of comparable size cannot be very great—even if "there's one born every minute." REBEL.

ACCIDENT CAUSES

Taking Advantage of Present Navigational Aids

DURING the last few months, in official and "bar" circles, a great many views have been aired on flying accidents and the public naturally began to take more notice when the relaxation of censorship permitted details of accidents to be reported. To dwell on past accidents is morbid unless useful lessons can be learnt, but I feel anxious to put a few thoughts into writing. My remarks in the main concern "unnecessary" accidents to passenger and freight aircraft.

It would seem that accident classification is very difficult as the occurrence of two identical incidents is almost unknown. A very large proportion of all accidents in the air seem basically attributable to pilot error, with a secondary aggravating factor responsible for upsetting the pilot. Trying for a moment further to break down the causes of accidents, this secondary factor will usually come under one of three main headings—(i) navigation, (ii) weather, or (iii) technical troubles.

Assuming that every possible effort is being made through good maintenance and the use of the best equipment to minimise (i), items (ii) and (iii) remain. Weather and navigation problems have been on our minds since before Pontius was a pilot and there is still little stigma in standing by the old axiom—"No see, No fly." The crux of the whole matter, to my mind, is practically summed up by that little proviso, and accident reports on almost every occasion could be briefly summarised as "He pranged because he could not see."

Having reached some sort of a conclusion, preventive measures can be considered. To fly when unable to see out entails two things, instrument flying and aids to navigation. Shortcomings in either are an invitation to disaster. Anyone who has read this letter so far may now say "What, all that preamble to reach two conclusions we already know about?" Well, the ball can fairly be pitched straight back at them. If we know about these things, why do we read all too often: "Bomber Hits Mountain Side" (aside—He didn't know his exact position) or "Pilot Loses Control in Bad Weather—Crashes on House" (aside—Instrument flying not so hot, eh?).

As far as navigation is concerned fewer and fewer accidents on our airlines should now be attributable to loss of bearings. Navigator training has been very good for several years and we have large numbers of excellent R.A.F. navigators available. There are radio and radar aids in plenty, thanks to wartime development. It is to be hoped that they have been installed or are being at present on all our trunk routes. By using radar such as Gee or Loran the risk of total radio failure, followed by loss of bearings due to bad weather on some of our tropical routes, should no longer be serious.

With regard to instrument flying, there must be, I think, room for quite a lot of improvement in standard of ability. In particular, regular practice in blind flying with one or more instruments blanked off on the panel is essential. Proper study of the effects of bad weather on the instruments is also called for. For example, all is not lost if one inadvertently blunders into a cu. nim. cloud, but unintelligent use of instruments in such circumstances is liable to result in a "pretty shaky do." By all means, as the book says, "Fly round cu. nim," but having on some occasion got into it what will happen to the instruments? Remember to expect your altimeter to wind up as you go up although the aircraft is flying in about the level altitude (i.e., don't put the nose down and start to dive). Expect your A.S.I. to drop back due to severe icing (i.e., don't push the nose still farther down thinking you have stalled and depending upon a heated pitot head not to have iced up in extreme conditions). Your artificial horizon will most likely hold out and together with primary instruments and combined use of compasses and directional gyro there is a very good chance of keeping control on a fairly even keel and with some idea of direction.

Cumulo-nimbus cloud must have been responsible for a number of accidents, but the difficulties of flying in it or any other turbulent conditions in a large aircraft are by no means always insurmountable and the cloud never covers a very large continuous area.

On the whole, I feel, it will be surprising if our accident rate does not show a steady improvement as, in fact, it has already started to do. The sudden public awareness of flying accidents had led many people to think of the past year or two as black ones for British air transport. This is quite unjust, as recently-quoted figures from a Transport Command authority show. DRIVER, AIRFRAME.

NATIONALISED AIRWAYS

The Value of Competition, if Any

I AM rather surprised at the attitude *Flight* is adopting with reference to the proposed nationalisation of our air transport. In your editorials and articles you are taking up the attitude that if nationalisation fails, then blame the Government; if nationalisation succeeds, then it will be due solely to the personnel who ran the new organisation. This means that whatever the fate of the new organisation, you are sure to have been right—although you hope all the time that it will fail.

Your arguments against nationalisation are very unconvincing. The main point you make is that the "competitive" spirit will be lacking, and this will lead to slackness and inefficiency. Surely, we shall have plenty of competition along our routes from American and other airlines? Considering the Atlantic routes alone, there will be American, French and Canadian airliners in the picture, and that will surely give us plenty of competition, without having our effort split up into small companies operating the same routes.

You will then say that we should not necessarily have duplication, and that each concern would operate in its own sphere. The next step would then be to form a monopoly, and we should have the airways controlled by a small group of capitalists. Nationalisation merely transfers the control from a capitalist group to the State. The success of any enterprise depends almost entirely upon its paid staff—in this case the success depends upon aircrew, ground staff, and management—and I am sure that they will not be less efficient when working for the State than when working for a capitalist board of directors. Will a man work less hard when he knows that the profits will be turned back into the common pool instead of going into the directors' pockets?

Let us have an all-out effort in support of the new airways,

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SUCCESSOR TO THE HAMILCAR

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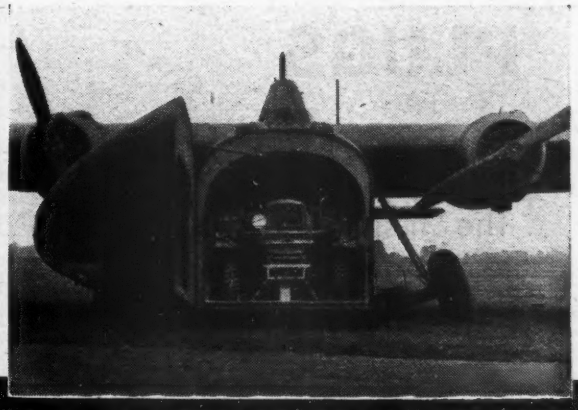

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CORRESPONDENCE

and let there be co-operation from top to bottom, with less of this cantankerous attitude towards the scheme. Success will not be achieved by adopting a sullen face and placing one's self in such a position that whatever the outcome one is right.

S. B. STUBBS.

[Our correspondent appears to do us rather less than justice. He is entitled to his views, but he does not seem to think we are entitled to ours. He is completely wrong when he states that we hope all the time that the nationalisation scheme will fail. We can assure him that no one will be more pleased than ourselves if the scheme succeeds, and if it does we shall gladly admit that we were wrong.

As for the "competitive spirit," we are aware that there will be more than sufficient competition from our American friends, but—and this is the whole point of our argument—with only one British Corporation competing with the Americans there will be no way of knowing whether its service is being operated as efficiently as it could and should be. With two British companies working in rivalry we should know which of the two showed the greater enterprise and efficiency. The United States recognises this fact, and Pan American efforts to secure a monopoly have failed.

All we are concerned with is that British airlines should be the best and most efficient in the world, and surely the time when they are being planned is the right time for stating one's views; afterwards it will be too late. Readers who hold views different from ours are quite at liberty to express them in these columns.—ED.]

COCKPIT CLASSIFICATION

Trade Approval for Colour Analysis

I WOULD like to make the following points in answer to "J. B." (*Flight*, December 27th) and "R. L. B." (*Flight*, January 3rd):

(1) "Splashes of colour" and "indescribable chaos" don't come into the picture. I have only suggested a thin coloured border (¼in. at the most) round the particular group. This has actually been tried in an Oxford, an aircraft which needs little change to fit the scheme. The effect was not that feared by your correspondents. Rather, it puts the instruments "on parade" in smart squads. A similar (but limited) idea can be seen in some American aircraft.

(2) I agree that standardisation is impossible, but this was the very point I stressed. Classification (with or without colour) could be a *uniform* system, and it is so elastic that it is feasible in any type of aircraft. Scale drawings of representative types confirm this.

(3) From the designer's point of view I agree with "J. B."—but because of lines, not of splashes. In any case, colour analysis of a cockpit as done in the *Flight* drawings would soon show up any faults. As a matter of interest, the design staff of two big aircraft firms have vetted the suggestion and deemed it workable from their point of view. So far as service aircraft are concerned, however, the matter is not in their hands.

(4) Most pilots agree about the grouping, but many shy at the colour. Once the kaleidoscopic effect (to quote "R. L. B.") is dispelled for what I actually suggest—a thin coloured line—then perhaps the suggestion is more palatable. The colour is only a label to any group, and is not so very frightening in moderation; we all follow the amber light for Paddington!

GORDON WHITE, A.R.Ae.S.

BOOK REVIEWS

"R.A.F. Coastal Command Leads the Invasion": by Sqn. Ldr. M. C. D. Wilson and Flt. Lt. A. S. L. Robinson; Jarrolds, 16s.

THIS is a good book marred only by the delay in production. It was written while the war was still in progress and the hold-up has been chiefly on account of the strict censorship imposed on Coastal Command. The two authors were in the Public Relations Department of the Command and, by virtue of this, in a unique position to collect authentic information and select outstanding photographs.

It is, however, no mere recount of the war as fought by Coastal Command. Running through the book is a thread of intelligent comment and the whole is a skilfully woven fabric with the war phases making up the main features and a wealth of detail to complete the pattern.

Anyone who served in Coastal Command, whether he was engaged in anti-U-boat work or in one of the anti-shipping strike squadrons, can read this book and say, "That is what I did in the 1939-45 war." The thrill of hearing the words "Action stations—Bomb doors open" come over the intercom. is captured for any aircrew member to relive as he reads the graphic accounts of aircraft *versus* U-boat flights.

"The Civil Air War," by C. G. Grey. The Harborough Publishing Co., Ltd., price 12s. 6d.

ALWAYS interesting, generally amusing and occasionally as vitally important as C. G. G.'s writings can be, *The Civil Air War* nevertheless leaves the reader wondering what it is really all about. Treated as a knowledgeable and chatty if sometimes repetitive tour through air transport matters, the book is outstanding; as a semi-serious history of world and Empire air transport it is, when read with caution, useful; but, perhaps because C. G. G., after all his years in aviation, can see so many sides to so many questions, it is difficult to identify any really definite line of political or operational opinion.

Nevertheless, *The Civil Air War* should be read by everyone who is interested in air transport matters, and certainly by the bureaucrats and others who are now to hold the reins. In this connection, it is a pity that the book was written before the change of Government, and that so much of it is consequently devoted to comment on a civil-aviation White Paper which is now as dead as the proverbial dodo.

The war which the title describes is really in three parts: that with the air itself in all its dangers; that between national air transport interests; and that in our own home world of civil aviation. It would be impossible to agree more with C. G. G.'s opinions in the matter of flying danger and in the need for its reduction by every possible means, but one is by no means convinced, for instance, that slow stalling speeds, achieved by much slottery and flappery, will do much to reduce this danger, and one is certainly not convinced that the danger of collision, other than with the ground, is seriously worth worrying about.

At least twice in the course of the book C.G.G. speaks fiercely of the awful consequences following the filling of the air with aircraft driven by reckless people. In point of fact, flying does not provide much incentive to recklessness—and certainly not in the form in which it appears on the roads, where a definite exhilaration can be obtained from speed as such or from the successful completion of a "phenomenal avoidance." There is hardly anything in flying which can be considered as "thrilling" in the same sense.

Nor can one take C. G. G.'s belief in airships too seriously. Given the necessary support twenty years ago, the commercial airship might possibly have come to stay, at least for certain purposes; but only experience would have shown whether such problems as those involved in icing and head-wind avoidance would have been insuperable in year-round operations over the entire world.

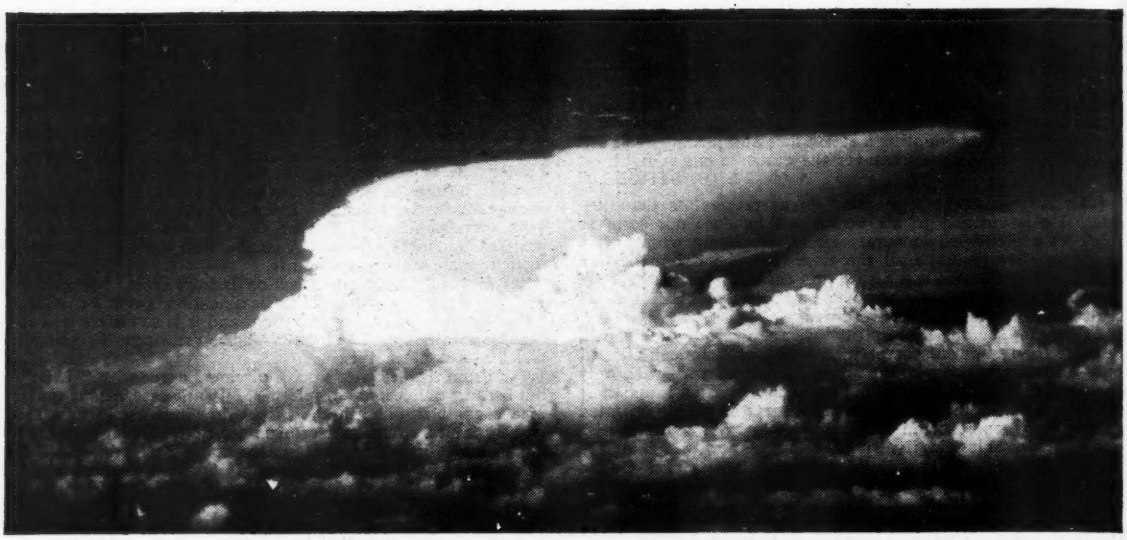
Probably the best and most comforting story in the book from the point of view of British civil aviation is that about the Liberator and the York on the Indian Ocean crossing. The regular service Liberator left West Australia while a York was still comfortably picketed down on the airfield. When the Liberator crew arrived at Colombo they were surprised and shocked to see the very same York bedded down and with its engine covers already in position.

H. A. T.

Aircraft of the Fighting Powers, Vol. VI, compiled by O. G. Thetford and C. B. Maycock; edited by D. A. Russell. Harborough Publishing Co., 31s. 6d.

Although the Powers have stopped fighting—well, more or less—the appearance of the sixth volume of *Aircraft of the Fighting Powers* is amply justified since the object of the series was to present a complete record of the military aircraft used by the warring nations during 1939-45. Thus the present volume, which covers 72 machines in all, introduces a number of types which, though not the very latest in existence, have been released for publication by the authorities since the previous volume went to press. Even this necessarily leaves out some which were still on the secret list when Vol. VI was "put to bed," and thus a seventh volume is promised to complete the range towards the end of the year.

The present volume adheres to the style and quality now familiar, and covers 26 British, 22 American, 15 Japanese, and nine German types. It includes a brief but copiously illustrated history of the Air/Sea Rescue Service, and a compendium of military aircraft markings.



IN THOR'S WORKSHOP: An impressive picture of the characteristic "anvil" formation found in cumulo-nimbus cloud.

SERVICE AVIATION

Royal Air Force and Naval Air Arm News and Announcements

New Year Honours

Royal Air Force Awards

Bar to Air Force Cross

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SQN. LDR.—P. V. Williams, R.A.F.O.
FLT. LT.—W. S. Jenkins, R.A.F.

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SQN. LDRS.—D. M. Alexander, R.A.F.V.R.; M. P. Brown, R.A.F.; J. P. G. Harris, R.A.F.; M. H. James, R.A.F.O.; S. N. Johnson, R.A.F.O.; W. W. McRae, R.A.F.V.R.; A. W. R. Perry, R.A.F.O.; R. K. Potter, R.A.F.V.R.; D. J. Rose, R.A.F.O.; D. E. J. Saint, R.A.F.V.R.; C. C. D. Williams, R.A.F.O.; F. J. L. Wyatt, R.A.F.V.R.; D. M. Anderson, R.A.F.V.R.; E. Bailey, R.A.F.; E. V. Best, R.A.F.O.; F. M. Biddulph, R.A.F.; M. G. Birt, R.A.F.O.; T. S. Blyth, R.A.F.V.R.; C. B. Brown, R.A.F.V.R.; F. H. Butcher, R.A.F.O.; A. Cholmondeley, R.A.F.V.R.; J. H. C. Clark, R.A.F.V.R.; D. H. Clarke, R.A.F.O.; G. A. Craig, R.A.F.; D. J. D'Alton, R.A.F.V.R.; W. A. Downes, R.A.F.; H. W. Edwards, R.A.F.; R. V. Ellis, R.A.F.; F. Ellison, R.A.F.; G. H. Godwin, R.A.F.V.R.; L. G. Holmes, R.A.F.V.R.; D. N. Hookway, R.A.F.V.R.; L. F. Humphrey, R.A.F.; J. A. Jarvis, R.A.F.; R. J. Jones, R.A.F.; W. Jones, R.A.F.; G. C. McCarthy, R.A.F.V.R.; J. D. Mallinson, R.A.F.O.; E. W. Partridge, R.A.F.V.R.; E. E. Pratt, R.A.F.V.R.; C. J. Rose, R.A.F.V.R.; A. E. Rumble, R.A.F.; D. G. J. Smith, R.A.F.V.R.; C. N. Spurdens, R.A.F.V.R.; T. Stevenson, R.A.F.V.R.; S. J. Thomas, R.A.F.V.R.; R. W. F. Wightman, R.A.F.V.R.

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SERGEANT.—D. H. Evans, R.A.F.V.R.
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Royal New Zealand Air Force

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FLIGHT LIEUTENANTS.—H. D. Alcock, W. P. N. Clarke, A. L. McGrath.
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Air Force Cross

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CAPTAINS.—M. S. Bryson, W. J. Townshend Smith.

Air Force Medal

SERGEANT.—V. V. Hastings.
CORPORAL.—S. E. Griffiths.

Australian List

Air Force Cross

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SQUADRON LEADERS.—R. G. Mullins, F. Cook, P. B. Sinnott.
FLIGHT LIEUTENANTS.—W. E. V. Boud, L. C. Glenwright.

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WING COMMANDERS.—L. G. G. J. Archambault, R.C.A.F.; R. E. Dupont, R.A.F.O.; R. C. Fumerton, R. W. Goodwin, R. J. Harvey, G. A. Hiltz, R.C.A.F.; J. A. Simpson, R.A.F.; H. E. King, J. C. Wickett, R.C.A.F.; W. T. Brooks, R.A.F.O.
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You take a man halfway across the globe, in the speedy comfort of your great air-liner—and then what do you do with him? Dump him at the airport and leave him to fend for himself? But he may still have two or three hundred miles to go. What he needs, of course, is a feeder service from the airport to the aerodrome nearest his final destination. Percival Planes are made for that job. . . . .

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SERGEANTS.—H. M. Hanna, J. A. Manley, R.C.A.F.

New Zealand List

Air Force Cross

Wing Cdr. L. H. Parry; Sqn. Lrs. J. W. H. Lett, G. C. Martin; Flt. Lts. A. F. Jacobsen, H. K. Patience, J. H. Penney; F/O. C. A. McDonald; all R.N.Z.A.F.

Badge of No. 788 Squadron, Naval Air Arm—"Tayari Saa Yote" (Ready at all hours). On a blue field, over water barry in base white and blue, and in front of two rays of lightning also white in saltire, a target proper pierced in the centre by an arrow gold flighted also white.

Badge of No. 799 Squadron, Naval Air Arm—"Το Δ'ΕΥ ΝΙΚΑΤΩ" (May the Right Prevail). On a field barry wavy of 12 white and blue, a roundel per fesse black and blue charged with an eagle volant gold in the claws a torpedo white. In chief three estailes also gold.

South African List

Air Force Cross

Lt. Col. F. L. Kotze, Lt. Col. C. T. Coppen, Lt. Col. J. G. J. Krige, Maj. J. Adam, Maj. E. K. Dunning, Capt. G. F. Behn, Capt. H. C. Boyden, Capt. G. G. Duncan, Capt. A. D. M. Lawrenson, Capt. S. Pienaar, Capt. R. F. Roberts, Capt. P. de Wet, Lt. W. G. Croxford, and Lt. J. L. Siddle, all S.A.A.F.

Roll of Honour

Casualty Communiqué No. 559.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 242 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. J. A. Brown; W/O. A. J. Dale; Act Flt. Lt. S. L. Woodcock.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. G. W. MacDonnell.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. R. Anthony; Sgt. M. G. Beckley; Sgt. D. Clark; Sgt. K. D. Daker; Flt. Sgt. P. H. Edwards; Flt. Lt. R. W. Nesbitt; F/O. E. Parker; Flt. Sgt. D. G. Patterson; Flt. Sgt. T. Pye; Flt. Lt. A. J. Strachan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. G. F. Abbott; Flt. Sgt. C. F. Adams; Sgt. H. Allen; W/O. L. J. Anstee; Flt. Sgt. W. F. Asker; Sgt. R. J. Atkin; Act. Flt. Lt. G. B. Aungiers; F/O. G. T. Baseden; P/O. A. C. Beattie; Sgt. W. W. Beattie; Sqn. Ldr. S. V. P. Bird; P/O. A. W. Bishop; Flt. Sgt. A. P. Bloomfield; Flt. Sgt. D. Bousfield; Flt. Sgt. T. C. Bower; Sgt. D. C. Brennan; Sgt. F. H. Brock; Flt. Sgt. P. W. Burr; Sgt. K. D. Burroughs; Sgt. T. H. B. Carden; Act. Flt. Lt. R. F. Carnegie; Sgt. R. P. Clancy; Sgt. S. Clubb; F/O. J. A. Cochran; Flt. Sgt. G. A. C. Coldridge; Sgt. R. F. Coleman; Sgt. W. F. Cowan; Act. Sqn. Ldr. L. E. Cox; F/O. K. P. McL. Cran; Act. Flt. Lt. G. S. Cruden; Sgt. E. G. Davies; P/O. J. Dickinson; Flt. Sgt. S. Dixon; Sgt. P. Donoghue; F/O. S. F. Durrant; Sgt. G. F. Ellis; F/O. J. C. Ellis; Sgt. W. English; Sgt. H. J. Evans; Sgt. A. W. Faircloth; Sgt. J. H. Fellows; F/O. D. A. Foster; Sqn. Ldr. J. Foulsham, A.F.C.; Sgt. L. Freyne; F/O. B. R. Garnett; Sgt. R. A. Gaut; Sgt. T. T. Golding; P/O. K. J. Gowing; Flt. Sgt. S. C. Green; Sgt. R. B. Hales; P/O. E. Hall; F/O. R. B. Hall; F/O. A. Hambly; Flt. Sgt. R. Hamilton; Sgt. F. Hardy; W/O. B. H. Harrison; P/O. J. A. Harrison; F/O. H. E. H. Healas; Sgt. A. C. Hickman; Sgt. B. F. Holland, Sgt. T. W. Hunt; Sgt. G. A. S. Johnstone; F/O. J. Johnstone; Ft. Sgt. E. F. Jones; Act. Flt. Lt. G. L. Jones; Sgt. A. J. Knight; Flt. Sgt. P. Lake; Sgt. B. Lansley; Sgt. J. Lawson; Flt. Sgt. A. A. Lee; Sgt. H. Lindsay; Sgt. T. A. S. Lookey; Flt. Lt. E. A. Loos, D.F.C.; Sgt. K. Lovatt; W/O. J. McCrone; Sgt. R. J. McDonald; Flt. Sgt. W. S. McIntosh; F/O. R. MacPherson; W/O. F. A. Mander; Flt. Lt. A. W. Manson; F/O. D. J. T. Marr; Flt. Sgt. G. J. O. Martin; Sgt. J. Marwood; Sgt. R. H. Mellard; Flt. Lt. J. W. Menzies, D.F.C.; Sgt. R. D. Mercer; Sgt. G. C. R. Micklefield; Sgt. J. M. Mitchinson; Sgt. W. W. Munn; F/O. A. W. Munro; Sgt. T. Myers; Sgt. R. Nevill; Flt. Sgt. V. L. J. Newell; F/O. F. H. Norman; Sgt. W. O'Connor; P/O. A. Orr; Flt. Sgt. D. F. Parsons; P/O. H. Pearson; Sgt. L. F. Pegg; Sgt. A. Perring; W/O. H. J. Phillip; Sgt. F. H. T. Powell; Sgt. D. L. Pratt; Sgt. J. W. G. Pringle; Sgt. C. B. Prophet; Sgt. G. W. Pusey; Flt. Sgt. R. Radford; F/O. G. D. Reen; Flt. Lt. W. E. Reynolds; Sgt. W. A. Roberts; Sgt. G. H. Robinson; Flt. Sgt. J. Ryan; Sgt. R. G. Seddon; F/O. E. R. Shepherd; W/O. E. G. Smith, D.F.M.; Sgt. J. F. N. Smith; Flt. Sgt. C. F. Spencer; F/O. C. E. Stamp; P/O. W. H. Stiffin; Flt. Sgt. E. F. Storrie; Flt. Sgt. K. C. Stuart; Flt. Lt. G. J. Summers; Sgt. J. M. Sumner; Flt. Lt. J. Swarbrick; Flt. Sgt. J. E. Talbot; Sgt. A. P. Tarr; Flt. Sgt. P. Telford; F/O. G. A. Thompson; Sgt. F. J. Tilbrook; W/O. M. Tilmont; Sgt. E. Topping; Sgt. A. H. Treadwell; Flt. Sgt. H. R. Vaughan; F/O. A. R. Verrier, D.F.C.; Flt. Lt. H. V. A. Vinnell; P/O. W. Warburton; F/O. G. Watkins; F/O. B. A. White; Sgt. G. Whyes; F/O. F. A. Wooding; F/O. B. St. J. Woollard.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sqn. Ldr. J. P. Gilliard, D.F.C.; Sgt. A. F. Grieve; Sgt. T. Jones; Flt. Sgt. W. R. Love; F/O. N. S. McEwen; Sgt. J. H. Marler; P/O. A. Mason; Sgt. F. E. Shaw; Sgt. J. M. Willby.

WOUNDED OR INJURED IN ACTION.—Sgt. E. L. Knightley.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. J. Davidson.

MISSING.—Flt. Lt. R. J. Allen; Sgt. L. Benfell; W/O. H. Campbell; Flt. Sgt. W. A. Devins; P/O. R. J. Duckworth; W/O. R. H. Durrant; W/O. S. J. Ellias; Flt. Sgt. H. Emerson; W/O. C. H. Griffith; Flt. Sgt. W. A. Hedderly; Flt. Sgt. A. S. Hemingway; F/O. D. J. Herbert A.F.C.; Flt. Lt. G. W. Hill; W/O. H. Johnson; Flt. Sgt. J. H. McDowall; Flt. Sgt. R. M. B. McPherson; F/O. H. Martin; F/O. I. A. Morgan; P/O. H. Parks; Sgt. D. D. Phelan; Flt. Sgt. A. Robertson; F/O. P. E. Rumsey-Williams, D.F.C.; F/O. R. Totham, D.F.C.; W/O. P. E. Turner; Sgt. A. E. Tyrer; Flt. Sgt. H. Wynne; Flt. Sgt. G. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. I. J. Calverley; Sgt. P. Gapper; Flt. Sgt. W. P. Gibson; F/O. M. P. Jones; Flt. Sgt. J. W. Montague.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. C. Bell; Flt. Sgt. S. T. Childs; Act. Sqn. Ldr. W. H. Corbet, D.F.C.; Flt. Sgt. R. St. J. T. Crawford; Flt. Lt. A. R. Elcock; Act. Sqn. Ldr. R. L. J. Fitch, D.F.C.; F/O. J. C. F. Gibson; Sgt. P. L. Greaves; P/O. L. G. Guest; Sgt. C. S. Jones; Sgt. J. B. Lambert; W/O. W. R. Martin; W/O. A. R. Nankivell; Sgt. F. A. Padmore; Flt. Sgt. K. Rhoden; Sgt. J. K. Roche; Flt. Lt. D. G. Rochford; W/O. P. A. H. Stone; Sgt. B. P. Van-Noey; Sgt. G. S. Watts; Flt. Sgt. J. M. Whyte; Flt. Sgt. D. P. Williams; Flt. Sgt. R. M. H. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. R. Hughes.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. H. L. Davison; Flt. Sgt. R. C. Raffan; F/O. R. E. Stacey.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—L.A/C. J. Ambler; P/O. A. W. Hawkes.

PREVIOUSLY REPORTED MISSING, NOW REPORTSD KILLED ON ACTIVE SERVICE.—Cpl. A. Petrie; Flt. Lt. J. Redman.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Wing Cdr. E. G. Hughes, D.S.O., D.F.C.; L.A/C. T. W. Pearson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. T. H. Cotterill; Flt. Lt. D. J. Hunter; Act. Sqn. Ldr. M. A. Spender; F/O. J. Wressell.

DIED ON ACTIVE SERVICE.—W/O. E. Bardsley; Sgt. H. H. Brown; Cpl. A. C. Gates; F/O. K. Gray; A/C.2 F. A. Griffey; Act. Cpl. R. J. Harper; A/C.2 L. A. James; A/C.2 P. Kelly; L.A/C. J. W. Kitchen; W/O. F. Larg; Cpl. R. Monk; Act. Cpl. A. J. R. Nicholls; L.A/C. F. Rowley; Cpl. M. A. Sandell; A/C.2 K. A. Slack; Sgt. W. L. Stott; W/O. C. N. Tester; Act. Flt. Lt. F. R. Walton; L.A/C. W. L. Williams; Sgt. R. P. Withrington.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. J. Swarbrick.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. E. Ball; F/O. E. C. Radford; Act. Flt. Lt. P. H. Strong, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. A. Bowern; F/O. L. J. Colgan; Flt. Sgt. D. J. Davey; P/O. J. Dickie; Flt. Sgt. L. T. Dwyer; Flt. Sgt. W. S. Evans; P/O. E. H. Gaggin; Flt. Lt. N. G. Gilmour; Flt. Sgt. N. E. Locklier; Flt. Sgt. P. W. Nicholls; P/O. R. R. Smith; Flt. Sgt. W. R. Vokes; P/O. W. A. Young.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. M. H. Pullen.

MISSING.—F/O. J. L. Howatson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. M. A. Chalmers; F/O. A. J. McCartney.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. C. W. Laing.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. S. A. Doherty.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. A. Bruce; F/O. A. J. W. Cayer; F/O. W. S. Curtis; P/O. A. T. Keeping; W/O. N. G. Marler; F/O. W. K. Marshall; Sgt. E. D. Wilmot.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. R. M. Almas; P/O. J. F. J. Bachant; Act. F/O. J. C. Badgley; Sgt. L. Basarab; F/O. A. J. Bate; Flt. Sgt. A. G. Best; F/O. D. L. Block; F/O. W. S. P. Bonar; F/O. F. H. Broad; Flt. Sgt. D. F. Brown; Act. Flt. Lt. P. L. Buck, A.F.C.; F/O. W. S. Burns; Flt. Lt. P. M. Charron; Sgt. W. J. Commins; F/O. J. M. Cordick; Flt. Sgt. K. M. Crayston; F/O. F. J. Crowley; Flt. Lt. J. W. Davidson; P/O. M. Dorrell; F/O. J. R. Dunford; Sgt. R. E. Fahselt; F/O. L. W. Frizzell; F/O. E. D. Hodgson; F/O. J. Holtze; F/O. J. W. Johnston; Sgt. C. A. Lord; F/O. C. H. Love; Flt. Sgt. J. Lupinsky; Flt. Sgt. J. M. A. McCann; P/O. R. J. McCormack; P/O. R. N. McEachern; P/O. S. A. F. McHardy; P/O. G. McLaughlin; F/O. W. F.

"Flight" photograph.

WEIGHT-LIFTER: The Firefly IV is capable of taking a widely varying array of equipment, from 2,000 lb. of bombs to 16 rockets. The aircraft above has a drop tank under the port wing, and radar equipment under the starboard.

SERVICE AVIATION

Moran; P/O. R. W. D. Murphy; Flt. Sgt. D. N. Page; W/O. L. P. Ramey; F/O. A. B. Rowley; W/O. L. J. Ruhl; F/O. E. J. Rusenstrom; F/O. J. B. Russell; P/O. A. G. Samuel; Flt. Sgt. J. Schafer; P/O. C. M. Wert; P/O. B. Zimring.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. L. McMillan, D.F.C.

MISSING.—Flt. Sgt. C. A. Keown; Flt. Sgt. R. J. McLean; P/O. V. D. Sweeney.

KILLED ON ACTIVE SERVICE.—W/O. S. H. Lorenz.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. J. A. Bryant.

DIED ON ACTIVE SERVICE.—L.A/C. A. Carrean; L.A/C. W. J. Craig; Sgt. J. E. A. Mugan; Flt. Lt. E. Parish.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Lt. J. G. Buchanan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. I. A. Blaikie; Act. F/O. W. R. Green, D.F.C.; P/O. D. K. Harris; F/O. D. S. Johnstone; Flt. Lt. A. M. McLeod; P/O. K. F. Morgan.

KILLED ON ACTIVE SERVICE.—F/O. A. J. Clarke; F/O. H. K. L. Rice.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. C. McInnes.

Casualty Communiqué No. 560.

Of the names in this list, 249 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Lt. C. H. Egerton-Eyes.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. J. H. Andrews; Sgt. T. W. Green; P/O. G. W. Harris; Sgt. J. K. Jury; Sgt. D. H. Moule; Sgt. J. R. Sadler; F/O. C. W. Thomas.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. T. Armstrong; F/O. P. S. Arnold; Flt. Lt. B. Atkinson; Sgt. J. Atkinson; P/O. R. J. Aubrey; Sgt. W. J. Beeson; Flt. Sgt. K. A. Brooke; Sgt. C. T. W. Carpenter; Flt. Lt. E. Cooper; Sgt. G. J. Cooper; Sgt. F. S. Crowther; P/O. J. M. Cunningham; Act. Sqn. Ldr. E. G. Daniel, D.F.C.; Flt. Lt. W. G. Davies; Sgt. D. A. Donoghue; Sgt. C. Erickson; F/O. K. P. Evans; P/O. F. Farnham, D.F.M.; Sgt. D. Farrall; Sgt. R. Fitch; F/O. A. A. Frederick; P/O. M. H. Gill; Flt. Sgt. R. Gledstone; Sgt. M. Goldman; F/O. T. Gould, D.F.M.; F/O. W. S. Griffiths; Flt. Sgt. R. G. Harwood; P/O. C. F. Hatch D.F.M.; Sgt. J. Healy; Sgt. W. Henderson; W/O. H. Hounsome; Flt. Sgt. V. S. H. Hoy; Sgt. H. D. Hoare; F/O. W. J. Hough; Sgt. J. E. Hughes; P/O. J. Kenny; Act. Flt. Lt. J. A. Kidd; Sgt. K. F. Knox; P/O. A. L. MacKenzie; Sgt. A. McKenzie; Sgt. A. McIntyre; Flt. Sgt. C. McRobb; Sgt. A. H. Mabey; Sgt J. Magee; Sgt. N. H. Maughan; Flt. Sgt. K. G. Meehan; P/O. C. F. T. Miles; P/O. G. C. Mitchell; Sgt. H. Newell; Sgt. H. W. Nichols; P/O. C. H. Ogden, D.F.C.; Sgt. G. F. Owen; Sgt. E. A. Padley; F/O. M. Pearce; F/O. W. W. Preston; Flt. Sgt. T. J. Priddle; P/O. L. Priestley; Sgt. K. G. Porter; Sgt. A. W. Radley; F/O. D. F. Rayment; Sgt. G. Richards; Sgt. J. A. Richards; Sgt. A. W. S. Robertson; Sgt. A. Ross; Sgt. W. F. Schofield; Flt. Sgt. J. G. Shaw; F/O. R. L. Smith; P/O. K. R. E. Spencer; Flt. Lt. B. Stroud; F/O. P. F. Sturges; Flt. Lt. J. MacG. Talman, D.F.C.; Sgt. C. Taylor; Sgt. O. Thomas; Sgt. R. J. Thomas; Sgt. E. Thomason; F/O. B. W. Thynne; Sgt. G. Tickner; Flt. Lt. T. E. Tranter, D.F.C.; Flt. Sgt. J. W. Wales; Sgt. N. Walters; Sgt. F. J. Webb; Sgt. E. E. J Wiggins; Sgt. J. W. Wood.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. P. F. Doyle; Flt. Sgt. T. W. Eckett; F/O. G. W. Goodacre; Flt. Sgt. K. Higgins; Flt. Sgt. D. N. Hogg; W/O. C. G. Lewis; Flt. Sgt. F. W. Stewart; Flt. Sgt. C. S. H. Watler; Sgt. R. E. White; Sgt. G. T. Wilson.

MISSING.—L.A/C. J. C. Fowler; Flt. Sgt. L. D. Horton; Sgt. R. M. Kemp; Flt. Sgt. E. W. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—W/O. A. M. Gates.

KILLED ON ACTIVE SERVICE.—A/C.2 F. D. Beverley; Cpl. N. C. Brimmicombe; Sgt. W. F. Colborne; Sgt. W. Dennis; Sgt. R. C. Develin; Flt. Sgt. J. Dyer; Flt. Lt. A. A. McK. Fraser; F/O. D. W. H. Furber; Flt. Sgt. K. Hird; Sgt. F. Jackson; Sgt. J. A. Jones; Flt. Sgt. L. Jones; Sgt. L. A. N. MacDonald; Flt. Sgt. E. Paige; L.A/C. W. Quinn; Flt. Sgt. J. Ross; F/O. T. G. R. Rowe; L.A/C. W. C. Spark; Sgt. J. Tait; Sgt. R. E. Tilley; Act. FIO. P. Tottle; Flt. Sgt. V. W. F. Townsend; L.A/C. W. H. Wardle; Flt. Sgt. P. C. Wyatt.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—W/O. R. N. G. Bray.

MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. K. G. Corton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. K. A. Poulden.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. L. Arthur; P/O. L. A. Carroll; Sgt. A. De Teissier-Prevost; Sgt. F. H. Ennis; Sgt. H. Freeman; Flt. Sgt. B. P. Nettleton; F/O. H. Rhodes; W/O. A. C. Shankland; Sgt. A. F. Smith.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C D. F. Dryden; W/O. J. L. C. Jones; Sgt. A. W. Kernohan; Act. P/O. D. R. L. Kitson.

DIED ON ACTIVE SERVICE.—L.A/C F. Aylward; Act. Cpl. M. Fleming; Sgt. D. H. Howland; A/C.2 J. Keighley; Cpl. L. H. Langelaan; Flt. Lt. D. E. A. Luger; Sgt. R. McCullouch; L.A/C. H. McCullough; P/O. A. E. MacDonald; A/C.2 W. McGivern; W/O. A. Pearson; Cpl. J. G. Richardson; Sgt. J. W. Sharp; Sgt. K. S. Shreeve; Flt. Sgt. B. P. G. Stopani; L.A/C. K. H. Thomason; Cpl. J. M. Tonkin; Act. Sqn. Ldr. E. H. Wingate; A/C.2 A. V. Wright; F/O. S. P. Wrigley.

Women's Auxiliary Air Force

MISSING.—S/O. N. C. Rees-Price.

DIED ON ACTIVE SERVICE.—A/CW.2 A. D. McBeath.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. C. E. Cock; W/O. A. R. Lyneham; P/O R. McA. Murray; P/O. V. Stuckey.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. B. Byrne; Act. F/O. A. G. Carter; Flt. Sgt. D. N. Charlesworth; W/O I. H. Clark; F/O. A. H. Francis; Flt. Sgt. J. B. De B. Griffith; Flt. Sgt. D. S. Mitchell; Flt. Sgt. C. K. Mollett; Flt. Sgt. P. R. A. Robin.

MISSING.—P/O. P. M. Gunn; P/O. T. K. F. X. Leavey; P/O. R. N. Pittendrigh; P/O. C. A. Walton.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. K. G. Kelly; F/O. F. N. Sorrell; Flt. Sgt. A. C. Wilkinson.

DIED ON ACTIVE SERVICE.—Flt. Lt. G. A. T. Davies.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. W. B. Arnold; F/O. G. A. Stewart.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. H. A. Adams; P/O. D. E. Aiken; P/O. N. W. Amstein; Flt. Lt. E. M. Andrew; P/O. H. F. Axford; F/O. N. Bailey; P/O. T. C. Barton; Flt. Sgt. J. H. Batt; P/O. G. R. Baumann; Flt. Sgt. C. A. Beanland; F/O. J. A. R. Belanger; F/O. D. E. Belt; F/O R. J. Bennett; Sgt. D. P. Bernhardt; F/O. G. Bishop; P/O. K. G. Boucock; P/O. C. D. Boyce; F/O. R. W. Blair; Flt. Lt. A. R. Blynn; P/O. R. A. Brett; F/O. H. L. Brown; Flt. Sgt. I. G. T. Brownlee; P/O. F. A. Burgess; W/O. L. W. Burnside; Flt. Lt. J. P. Calder; F/O. G. E. Cameron; Flt. Sgt. A. E. Candline; P/O. M. J. W. Cantwell; F/O. T. Carnegie; P/O. R. W. B. Carey; F/O L. W. Cartwright; P/O. L. F. Cassidy; P/O. R. G. Cassidy; P/O. G. A. Chapman; F/O. E. A. Clarke; F/O. J. B. Collver; P/O. P. E. Coltman; P/O. J. Cook; P/O. B. H. Cooper; P/O. M. W. Couper; P/O. E. G. Crawley; P/O. V. C. Cully; F/O. L. F. Curry; P/O. N. Cushman; F/O. J. T. Daly; F/O. A. A. Desilets; P/O. W. W. Downer; P/O. J. R. Dryden; F/O. J. I. Duguid; P/O. J. M. Eadinger; F/O. A. G. Echlin; P/O. A. R. Elliot; Sqn. Ldr. D. W. Farrell; F/O. L. R. Fennell; P/O. R. S. Ferguson; P/O. L. E. Findlay; F/O. R. S. Forestell; F/O. A. Forsyth; P/O. R. L. Frankfurth; F/O. P. J. Gandy; P/O. B. A. Gauthier; P/O. W. C. Gay; P/O. J. Gibson; F/O. H. G. Gilchrist; P/O. W. L. Gillespie; F/O. A. Glendenning; F/O. M. M. Golub; Sgt. J. N. Gordon; F/O. F. C. Goring; P/O. F. G. Graham; Sgt. N. Gronbeck; P/O. J. K. Gustafson; P/O. C. B. Haaland; P/O. N. E. Hagerty; Flt. Lt. R. L. Harman; W/O. G. F. Harrison; Sgt. J. R. Hawkins; W/O. J. W. Heavner; P/O. J. T. Hemsworth; P/O. G. A. Hergott; F/O. A. J. Hoddinott; P/O. G. K. Huish; Flt. Lt. W. D. Idema; P/O. L. Image; Flt. Sgt. G. J. Inverarity; F/O. F. A. Jeffrey; F/O. W. J. Kasubeck; P/O. J. R. Kellum; F/O. J. J. Kommes; P/O. T. Krynski; P/O. F. L. Ladd; Flt. Lt. H. M. LaFlamme; Flt. Lt. D. D. Laird; P/O. R. A. Leach; P/O. R. A Leman; F/O. J. Leonard; W/O. A. C. Lornson; Sgt. A. A. McCallum; F/O. M. McAulay; F/O. R. E. G. McCurdy; F/O. W. E. McDonald; P/O. R. E. MacFarlane; P/O. P. G. MacGregor; P/O. J. W. A. Mackie; P/O. R. F. McKinney; P/O. J. R. MacKinnon; F/O. G. H. McLaren; F/O. J. K. McRobb; Sqn. Ldr. I. MacK. McRobie; F/O. G. R. Murphy; P/O. J. F. Murphy; P/O. W. A. Murray; Flt. Sgt. W. R. Moore; P/O. A. J. Morgan; F/O. L. E. Morgan; F/O. F. K. Morley; F/O. W. C. Morrow; P/O. F. D. Miles; F/O. G. R. Miles; F/O. A. C. G. Mercer; P/O. T. E. Magill; P/O. A. F. Marsden; P/O. H. R. Mason; Flt. Sgt. J. L. Nelson; P/O. D. M. Norris; Flt. Lt. E. Northern; W/O. J. J. Ollinger; W/O. J. O. Paige; Flt. Sgt. D. B. Richardson; W/O. R. A. Riddoch; P/O. C. Senton; F/O. J. W. Stapleton; F/O. A. G. Striowski; W/O. A. A. J. Tremblay; Flt. Sgt. R. W. T. Ulens; F/O. J. M. Westlake; W/O. H. W. Wilson; P/O. V. Zulinov.

VICTORY OVER JAPAN : Graveyards of Japanese aircraft are to be found all over the Far East That shown above is at Seletar, Singapore ; the aircraft are Jakes reconnaissance float-planes.

(Left) Badge of No. 885 Squadron, Naval Air Arm—"Celerrime" (Very Quickly). On a blue field issuant from water barry engrailed white and blue, flames proper therein a cat affronte black. (Right) Badge of No. 827 Squadron, Naval Air Arm —"Ya-Mansur-Amit" (O! Conqueror fight desperately) On a field per fesse wavy white and barry wavy of six blue and white, a rod caduceus and a trident in saltire gold. In chief a winged cap red.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. W. J. Byrne; Sgt. M. M. Cummins; Flt. Sgt. P. C. Doherty.

WOUNDED OR INJURED IN ACTION.—Flt. Lt. J. C. W. Olson.

MISSING, BELIEVED KILLED IN ACTION.—F/O. F. V. Brennan; F/O. R. R. Chappise; Sgt. J. C. B. Ekeberg; Sgt. J. A. Farr; F/O. A. S. Gibbon; F/O. W. E. Mittay; Sgt. M. Mostowy; Sgt. G. W. A. O'Connor.

KILLED ON ACTIVE SERVICE.—Sqn. Ldr. J. R. Beirnes, D.F.C.; F/O. D. M. Eastman; Sqn. Ldr. W. T. Klersy, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. A. Johnson; P/O. F. W. Logan; L.A/C. N. Somolenko.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. J. E. TAYLOR.

DIED ON ACTIVE SERVICE.—L.A/C. S. H. R. Brown; Flt. Lt. W. N. Douglas; L.A/C. R. Easter; L.A/C. A. S. Friar; Flt. Lt. J. W. B. Povah.

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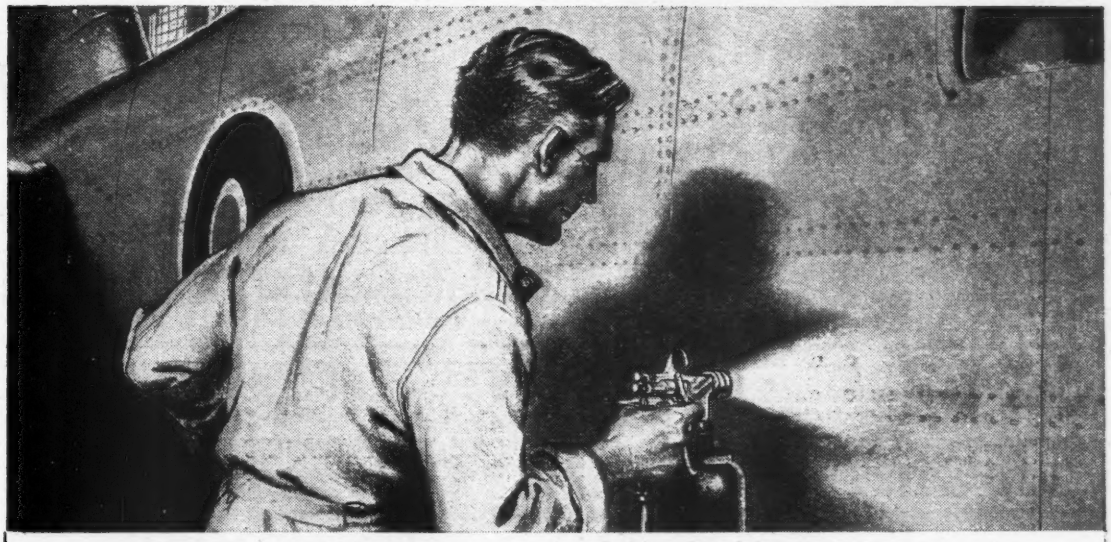

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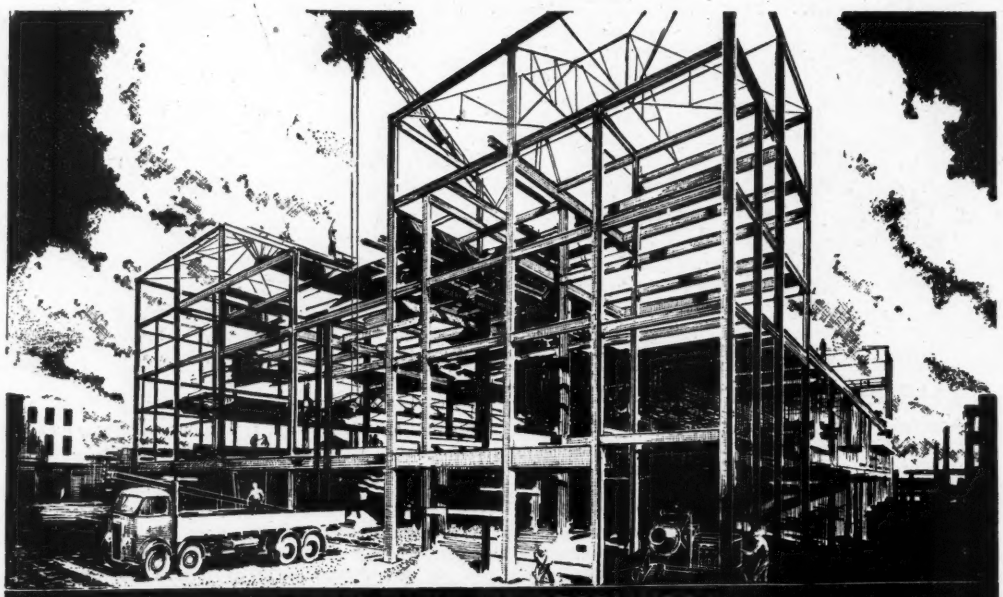

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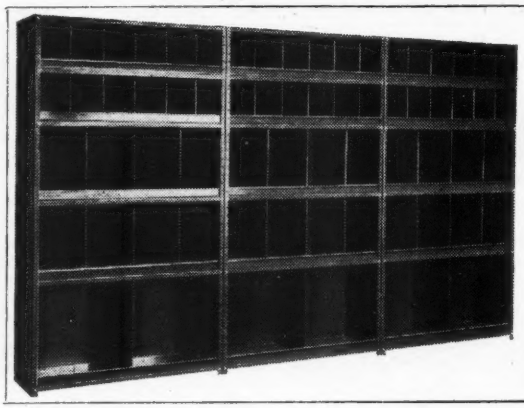

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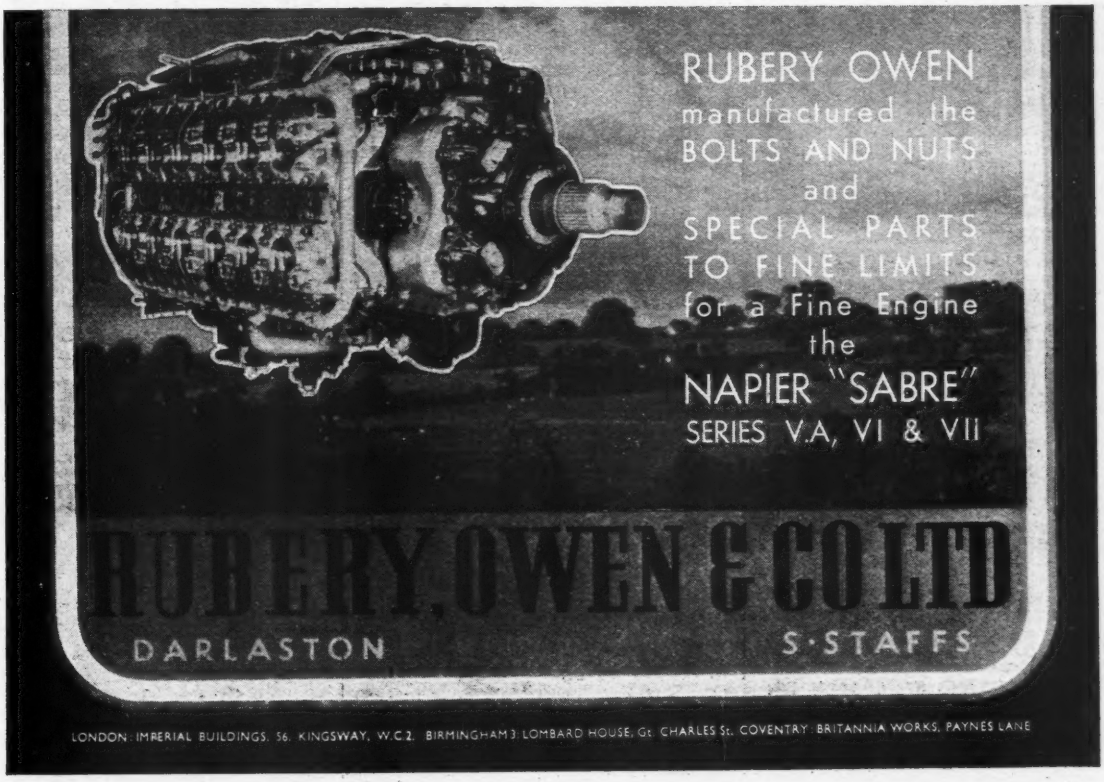

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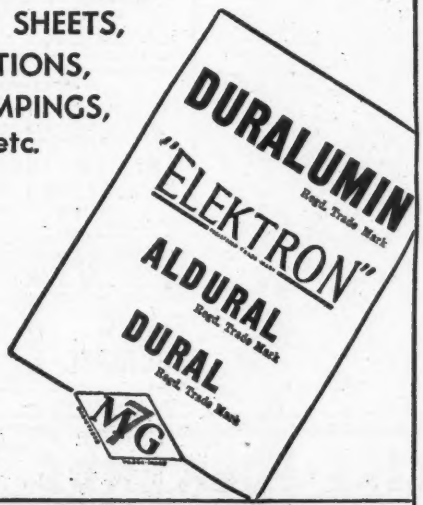

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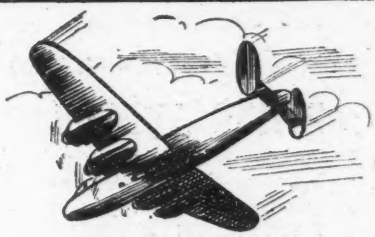

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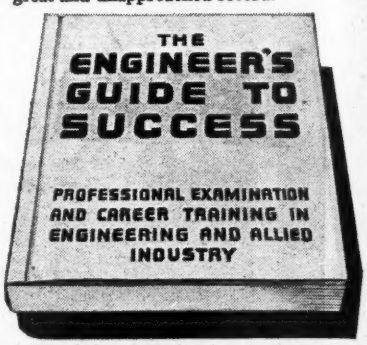

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AERO-ENGINE fitter (experienced) required for experimental establishment; ex-R.A.F., Halton apprentice would suit.—Write stating age and experience to Personnel Manager, D. Napier and Son, Ltd., Luton Airport, Beds. [6417

AIRCRAFT draughtsman, first or second grade with design knowledge of dinghy and air-sea rescue equipment systems and installations in aircraft; design knowledge of dinghies an asset but not essential.—Box 5074, c/o *Flight*. [6418

EXPERIENCED coppersmiths required for experimental aircraft work; Class A release men welcomed if suitably experienced:—Write stating age and experience to Personnel Manager, D. Napier and Son, Ltd., Luton Airport, Beds. [6416

MOTOR vehicle electrician wanted for large repair shop; good opening for thoroughly skilled man; write or 'phone in confidence.—Kingston Hill Motor Works, Ltd., main dealers for Bedford and Vauxhall, Kingston Hill, Surrey. Tel. Kingston 3351. [6414

WELL-KNOWN aircraft manufacturers engaged on the production of civil aircraft are seeking the services of a foreman for their fabric department; must have pre-war experience in cellulose spraying in the aircraft industry.—Box 4852, c/o *Flight*.

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SENIOR and junior design draughtsmen required for work on new type of civil aircraft, good prospects with progressive firm situated within 30 miles London.—Write, stating age, qualifications, experience and salary required, to Box 4954, c/o *Flight*. [6383

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DRAUGHTSMAN, senior, well versed in the design of small, intricate, mechanical components; must have a good knowledge of modern gear practice.—Applicants are requested to write giving full particulars of age, experience and salary required to Box 5071, c/o *Flight*. [6410

WANTED, ex-W.A.A.F. personnel for civilian operated motor transport storage and maintenance unit in the following trades: typists, clerical, stores, maintenance, drivers, canteen staff.—Apply Personnel Manager, Marshalls Flying School, Ltd., The Aerodrome, Cambridge. [6193

SENIOR personnel are required for project design, weight control, installation of service equipment, aerodynamics, performance calculations, strength calculations.—Full particulars, experience and salary required, to Taylorcraft Aeroplanes (Eng.), Ltd., Thurmaston, Leicester. [6371

AERO engine stressing.—Required immediately, in the London area, an engineer fully experienced in all stress calculations for aero engines.—Applicants should write, stating age, qualifications, particulars of experience and salary required, to Box K.X.3, c/o 5, New Bridge St., London, E.C.4. [6352

TWO aircraft stressmen required for senior positions in expanding design office in Yorkshire, applicants must have had minimum of five years experience of aircraft stressing in all phases and be capable of leading junior personnel and also planning of complete type record.—Box 4953, c/o *Flight*. [6382

DESIGN engineer capable of initiating design and development of small, high efficiency gear boxes and similar components; some knowledge of low-voltage electrical practice would be an advantage.—Write stating age, experience, professional qualifications (if any) and salary required to Box 5072, c/o *Flight*.

EXPERIENCED weight estimators required, must have sound knowledge of practical mathematics and can estimate weights from drawings and compile statistics; good prospects with progressive firm situated within 30 miles London.—Write, stating age, qualifications, experience and salary required, to Box 4955.

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ASSISTANT chief draughtsman required in Birmingham area for company engaged upon aircraft and light engineering, previous aircraft experience and ability to control staff essential, electrical and project development experience desirable; good prospects for man with these qualifications.—Box 5052, c/o *Flight*. [6402

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PATENTS

NOTICE is hereby given that Miles Aircraft, Ltd., and George Herbert Miles seek leave to amend the Specification of the application for Letters Patent No. 563,467 entitled "Improvements in aircraft." Particulars of the proposed amendment were set forth in the Official Journal (Patents) No. 2,972 dated January 9th, 1946. Any person may give Notice of Opposition to the amendment by leaving Pat nts Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, on or before the 9th February, 1946.—H. L. Saunders, Comptroller-General. [6409

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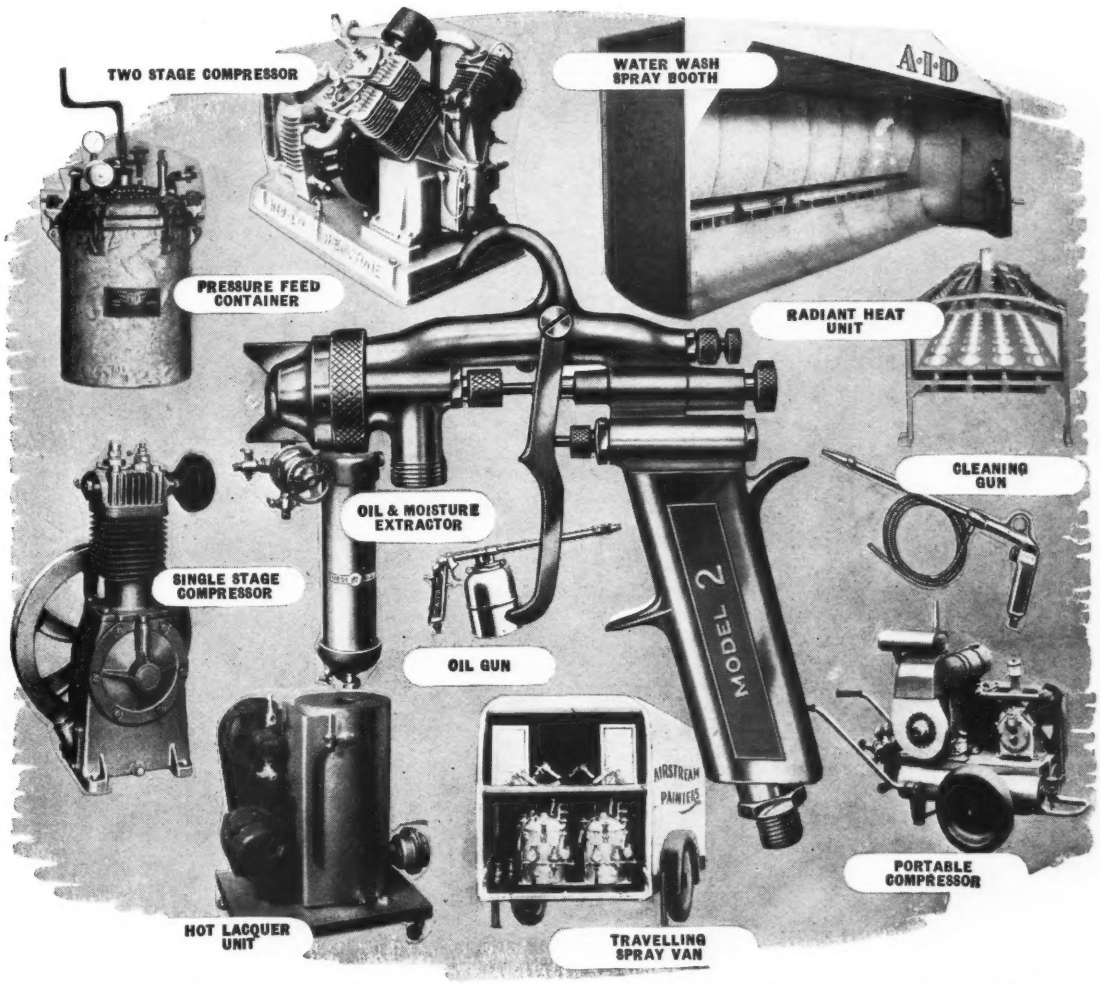

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